



Issue 333

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Our Beloved Prophet in Geneva airport a few days ago, surrounded by Swiss Raelians who came to wish Him a nice trip and also to thank him for the pleasure they had to be near him for the past few months... whatever the authorities may say ☺

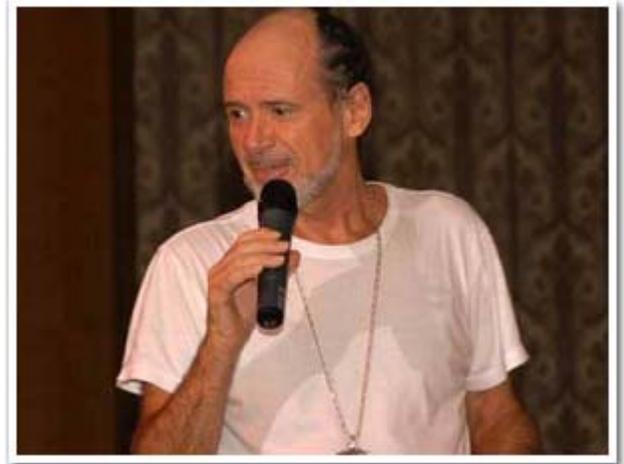
*You are the living dream of the Elohim. With our dreams and our changing of the planet into a planet of dreams, we realize the dream of the Elohim as their dream was to create a planet with people who have fun, who are happy, harmonious....*

# Compassion - Be Your Own Guide.

Words of our Beloved Prophet, taken from notes at the Winter Seminar in Switzerland last February. More notes to come in the next few Contacts.

## Compassion and Empathy begins with Oneself.

Within us, we all have a sort of double personality. There is the ordinary human being whom we can call **unconscious** and then there is **consciousness**. Consciousness is only able to bring empathy and compassion. Unconscious can kill everybody, can become the military or Bush. He is the ordinary person with all of the potential for bad. The unconscious can sometimes do good things unconsciously. Consciousness however, always chooses good. As soon as there is consciousness, there is love and good. We must really consider ourselves as a double person.



When I use my consciousness, the other being capable of the worst is there too. You have all done terrible things, you know it, you have done things that you regret, that you wish you had never done or said. You made some people suffer, you stole, you may have even killed; everything is possible. This is where you first have to forgive, and to forgive yourself. But to do so, Consciousness needs to talk to us first, it needs to take the hand of the little child that is the unconscious being that we are, at any time, and tell him: "you made a mistake, but it is going to be ok, I will guide you". Before anything, you must be your own guide.

What does that mean to say that consciousness must guide us? It means that there is an individual to guide.

It is so easy to see oneself as a guide for others; it allows us to forget how much we need to be guided. If you want to be a great guide, start by guiding yourself, by taking yourself by the hand and guiding you towards good and love.

Look at yourself with the capacity to love your flaws, to love all of your past, all the mistakes you made, applying 'forgive them for they don't know what they are doing', which in that case becomes 'forgive me, I didn't know what I was doing'. Forgive me, myself, because I didn't know what I was doing, I wasn't conscious, I wasn't loving and this is why I had people suffer.

Look at yourself with compassion and love, take yourself by the hand and talk to you – I do it myself – do it, even if you are afraid of being taken for a 'nut' because you are talking to yourself, just tell yourself 'stop it'!

## No one is perfect, not a Guide, nor Me or the Elohim.

Sometimes, looking at the planet, I lose hope a little. It happens to me, it is my flaw. Sometimes I tell the Elohim 'I am fed up, come and get me, I don't want to see them anymore'. Then I talk to myself, I remind myself that if I am here it is because it isn't over, I still have things to do. I look at the Raelians who are here 100% with me and I tell myself that I have to keep on going and I fight.

It probably happens to you too and it is normal to be desperate for a short moment when we see what is going on around the planet, when we see how people react to the simple fact that we are Raelians. (Referring to the way French and Swiss people react in these two countries). What is our crime? How many people did we kill or murder?

Our crime? We believe in Extraterrestrials!! This is serious! ☺

We believe in UFOs... "Let's burn them!!" ☺

We believe in cloning... it never hurt anyone to my knowledge, did it?

What is our crime?

However, for the people who circumcise their children and cover women with veils, for these people we must show tolerance, we must show respect in society, we must accept their difference. Their book says that we must kill Jews and Christians. No problem the majority says, we have to be tolerant!

But for the Raelians who believe in Extraterrestrials, no more tolerance.

Sometimes I tell myself, what am I doing here? But then I talk to myself ☺

You must take yourself by the hand like that and tell yourself: *'my consciousness is going to talk to this unconscious being who is reacting'*.

It is true that sometimes we feel like reacting emotionally and that everything pushes us to do so in our society, as they 'fly rather low' on average.

But it is true for everything and especially for self-love. One must take oneself by the hand and love oneself. Once you have this compassion and empathy for yourself, only then can you have some for others.

As long as you haven't cleansed yourself within - that you haven't forgiven yourself, that you haven't reached the level where you love yourself unconditionally, with all your flaws, problems and insufficiencies, then you won't be able to love other people.

To love one's flaws doesn't mean that one will not try to improve, but one must first love oneself and only then does one do all that one can to evolve.

We must accept the yin and the yang - the complete individual.

Always keep in mind this little child whom you take by the hand, even if you are 80.

The conscious guides the unconscious.... Be your own guide!!

## News and Views

### Some progress in sexual awareness this week...



**In France**, Raël expressed his support for Professor Waynberg, President of the Sexology Institute, who advocates the fact that handicapped people should be able to have a sexual life!

During a symposium in Strasbourg at the European Congress, he outlined the fact that the sexual life of handicapped people was a taboo in France. He suggested that like in Netherlands, Germany and Switzerland, France puts in place professions that would be called 'sexual helpers' for example, who would provide kisses, caresses or massages to handicapped adults... quite logical isn't?



RAEL, the only spiritual leader to preach for a free sexual life, has also sent his congratulations to the Brazilian anchor who is shown in the following video explaining quite thoroughly how to have anal sex, and this was at prime time ☺

LiveLeak.com - This is Brazilian Television! - Anal Sex Lessons on Prime Time TV:

[http://www.liveleak.com/view?i=d9a\\_1176955539](http://www.liveleak.com/view?i=d9a_1176955539)



Another woman is changing her society, in Egypt: Dr. Heba Kotb who is talking about sex openly on a show broadcast all over the Middle East, tackling a taboo in the Arab world before anyone else. She talks about masturbation, sex over the Internet, sex and Ramadan. It's a big first in these parts of the world and her main advice for married couples: Have more sex. He he, can't hurt ;-)

Hopefully she will soon be able to talk about sex outside of marriage etc... our Beloved Prophet congratulated her this week.



The USA has lots to improve in that domain as well. Our Beloved Prophet asked us to support the young Genarlow Wilson who is serving a 10-year sentence in prison in Georgia, USA, for consensual sexual activity. When he was 17, Mr. Wilson received oral sex from a 15-year-old girl. For that, he has served over two years of a strict minimum decade-long prison term. He was convicted of aggravated child molestation, a charge intended for adult sexual predators.

If Mr. Wilson had engaged in sexual intercourse with the same girl, it would have been a misdemeanor under an exemption for contact between minors. Oral sex was left out. Legislators have since corrected the unintended trap. If Mr. Wilson engaged in the same action today, it would be a misdemeanor but there is no bill yet that would have allowed judges to review sentences in cases like Mr. Wilson's. Hopefully they will fix that as well and enable the poor boy to get out and live his life!



RAEL also sent his support to Mike Penner from the LA Times who wrote a beautiful article this week starting like that(not necessary):

*"During my 23 years with The Times' sports department, I have held a wide variety of roles and titles. Tennis writer. Angels beat reporter. Olympics writer. Essayist. Sports media critic. NFL columnist. Recent keeper of the Morning Briefing flame. Today I leave for a few weeks' vacation, and when I return, I will come back in yet another incarnation.*

*As Christine.*

*I am a transsexual sportswriter. It has taken more than 40 years, a million tears and hundreds of hours of soul-wrenching therapy for me to work up the courage to type those words..." A little further he says: " Transsexualism is a complicated and widely misunderstood medical condition. It is a natural occurrence — unusual, no question, but natural."*

Yes ! ☺



Our Beloved Prophet also congratulated President Hugo Chavez who took control of the world's biggest oil companies(the plural is already provided with 'operations', ie 'oil company operations') operations in the Orinoco Belt crude projects. This takeover comes exactly a year after Bolivian President Evo Morales ordered troops to seize his country's gas fields, accelerating Latin America's struggle to reclaim resources. Our Beloved Prophet also expressed his hope that this decision serves as a great example for the whole world, especially for Africa!



RAEL also congratulated Ecuador's President Rafael Correa, in the footsteps of President Chavez, for his victory in a referendum on overhauling the political system. It seems that more than 70% of the population was in favor of his proposal to by-pass Congress and rewrite the constitution.

Correa also threatened to kick out the World Bank's representative and said he would no longer deal with the International Monetary Fund, the debt has been repaid and he doesn't want to deal with that international bureaucracy anymore.



Finally two beautiful articles, amongst the most important of the year, have been selected by our Beloved Prophet. You will find them in full at the end of this newsletter... a must read !

Their titles: "A Fractal Universe?" and "Could Black Holes Be Portals to Other Universes?"

# News from the Raelian Planet

## From our New Iranian Leader

How can I explain, the very special feelings I got through the seminar in Antalya!

I believe, one of the most important points in the Messages, is that the promised Paradise of all the religions, necessarily, is not in another place where we should transfer to, but it is the straight fruit of unity and mutual understanding between human beings in an area lighted by the rays of Knowledge plus Love and Consciousness, it means we, human beings, have the ability to create the Paradise, as our Fathers do, just if we observe three conditions:

- Knowledge and Science
- Pure Consciousness
- Absolute Love

Then, we can transform any dark hell into a peaceful and joyful Paradise,

Today, we are right at the edge of our human generation's Golden age, by the considerable steps through the path of knowledge, and our Fathers' promise to give us their heritage of 25,000 years of knowledge, just IF we consider the other two conditions.

Now, I can acclaim, that we had a taste of Paradise together through this Seminar, and how simple such Paradise might come into existence in the area of Love, Peace and Unity?

I want all the people to know that I, an Iranian, experimented the most loving feelings of friendship and unity with my sisters and brothers of other nationalities, especially the ones from Israel, and I want to share this great feeling with all human beings around this planet: that just a minute of such living in the atmosphere of love is much more precious than years of living with previous thoughts and ambitions; even if it causes one to be the owner of the world's wealth? Also with all the absurd religious fights, which means that one is the owner of spirituality more than the others!

Unaware of the fact that such claim doesn't have anything to do with spirituality, and etc. we can easily find so many examples around?

I hope everybody can taste a minute of this great Paradise, and by the way, our world might change like this!

I think the other people in the Antalya hotel, did not imagine that we gathered from different nationalities, which are known as enemies through this planet, and also it might be a question for them, how can we hug each other with so much warmth, because this is our first meeting! But, if they had just found out the deep human Raelian Philosophy that was given to our Beloved Prophet, it wouldn't have been strange for them anymore, and they also could embrace other human beings, who might have been introduced as their enemies, by governments, for many years, and no more pain would remain. This is a real Paradise!

We tasted paradise together, 1st of April 2007, (or should I say: year 61 of the Apocalypse!) during our seminar in Antalya, and this sweet taste, will never be forgotten!

With all my love!

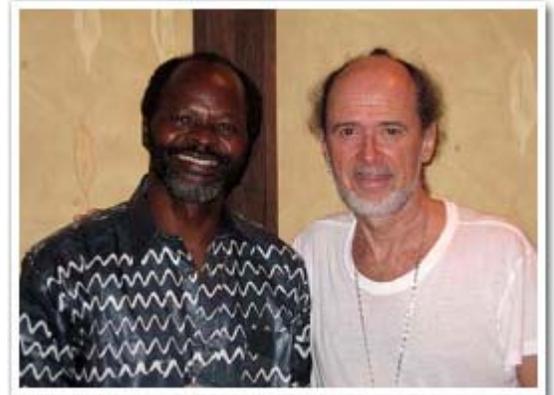
Eloray

*National Guide of Iran*



## Mission in the South-East English speaking part of Kama

*By Lamane, Bishop Guide (in the photo next to RAEL)*



My mission of spreading the Messages of our Beloved Prophet in the South-East of Kama is going well. I am on a high since this night, on April 9 in Maseru, the capital of Lesotho, where I saw a beautiful light in the sky as the one we saw on August 9th during the seminar in Elohika!

On the 10th and the 11th, I met with the personal adviser of the King of Lesotho in the Royal Palace. To see this man is like seeing the king according to what people say here and he admitted it as well ;-) We are friends. He was so full of enthusiasm to receive the messages: the book and the Words of our Beloved Prophet for Africa which he will give to the king. He was so pleased to hear about a religion which supports traditional chiefs. He is 80 but was so sharp and witty.

Besides the palace, I had interesting contacts with young people.

After three days in a bus, I arrived in Nongoma, the city of the king of Zulu in the middle of Kwazulu Natal. However the King and his personal assistant Mr. Sithole were in another city, Durban... Nice phone conversation with Mr. Sithole who tells me to come back to see the King as he loves agriculture. The messages and the Prophet's Words are left with him for the King.

Then I went to the capital of Swaziland, Mbabane, where I arrived late at night. A few days later I was welcomed by the vice-minister of Internal affairs who understood the importance of my mission and helped me fully to get in touch with the King's adviser whom was recommended to me by the adviser of the King of Lesotho. But they are all in another city, some 150km from where I was for the preparation of the 39th birthday celebration for the King. I then wrote a letter of introduction to support my request to deliver the Messages and I anonymously participated in the birthday celebration the following day. Beautiful party, nice speech by the King who is deeply loved by his people. He called for peace, for more value to the traditional culture and harder work for a better economy.

A few days later I was able to have an excellent meeting with the King's Counselor. He explained to me the whole path so that I could meet with him. I will have first to meet with one of the King's secretaries who will make his report before I can meet with the King. The counselor loved the messages, I could feel it and he was confident that I would be able to meet with the King soon...

**Note:** I was so surprised to see the kingdom so invaded by Christianity (Evangelists).... This beautiful country of 17,000 km<sup>2</sup> and 1.1 million inhabitants (no mosquitoes at all at this time of the year) really needs the Prophet. I mentioned to the counselor that this message may not please the Christian people who surround the King but he answered that I shouldn't worry as even if the King is Christian, he is quite open-minded and insists on tradition. When the time came to write the constitution, the first project was starting with the following sentence: 'Swaziland is a Christian Country'. The King was outraged and he resisted alone against the pressure of all, including his close circle and his wives, and succeeded in having this sentence removed.

Dear Beloved Prophet, may your decision rule. Thank you our Fathers for the privilege I have to be a disciple of RAEL your last Messenger....

Love, Lamane

## Meanwhile...

In Mali, Xciel was with the Counselor and personal friend of the Minister of Culture. "I just gave him the Messages (VVD) and the Words of our Beloved Prophet about Kama. He promised he will put me in touch with the minister to whom I intend to talk about the United Kingdom of Kama Project."

## France: Princess on Stage

*By Philippe Levaux - Guide (in the photo with Princess Loona)*



What an extraordinary day on Sunday April 29th! So many emotions and courage from everyone.

It was about 2 weeks ago, I was able to ask Dieudonne (A French stand-up comedian) to present Clitoraid in the first part of the show he was planning to do between the presidential elections. (Dieudonne has been a potential candidate for almost a year).

The answer of Dieudonne was immediately positive and we took an appointment with Princess Loona and Abdou (Boudha) to meet him and prepare the talk of our spokesperson and the video of Banemanie (see the Clitoraid's video).

Dieudonné could easily see that Banémanie who was so touching in her testimony was a Raelian Bishop, but he didn't give a damn.

And here we are backstage around 2pm while the show starts at 5pm. We discuss the latest details with Pierre a member of the team with whom I have become friend not knowing he would be involved in the animation of Dieudonne's show 😊

Princess Loona as usual is very concentrated, considering several scenarios. The pressure is getting higher when one of Dieudonne's assistants comes to say that she shouldn't insist much on Rael; one must know that Dieudonne has been under high pressure because of his statements regarding the Jewish community in France and in Israel. Dieudonne often says that there is only one race, the Human Race. Despite that he is often considered as anti-Semitic in France.

The first part has started, Princess Loona is stretching behind the huge black curtain of the « Palais des Sports » where about 3,000 people are gathered. There are many journalists present to hear what Dieudonne has to say about the Presidential candidates... One comedian passes, another one whom the public dislikes! Stressed backstage; I feel relaxed and confident. It is Princess's turn.. she starts to talk. I go close to Dieudonne who is also there behind the famous curtain, I hold his arm and his hand and tell him "everything will be ok" and then the miracle happens), the crowd applauds Princess once... and a second time! Huge smile from Dieudonne who has decided to act for Africa ; it is his vocation and this is why we meet. The video is on and intense applauds start after Banemanie's testimony.

Princess is moved, a few tears appear, Dieudonne comes to us and reassures her, he is happy. If some have been shocked because she talked about masturbation, great, that's what we are here for. The reconstruction of clitorises in Africa becomes a reality for the public which came to listen to Dieudonne, Africa's spokesperson. He had the guts to have Raelians speak about a great idea; normal, he preaches the freedom of speech;-) He will end his show with all

the religions, including the Raelians, and all would say that the public was very respectful at the exit taking Clitoraid's pamphlets and were talking about Rael and this extraordinary action.

Love, Philippe Levaux

**Princess Loona was also on a TV show recently. Here is an email we received a few days later:**

Good day,

Your talk on Saturday on the cable has touched me...

Congratulations for your desire to defend your opinions and your ideas about Rael. I know very little about this movement and this philosophy, but you have been very convincing and really great during your talk.

If you can give me more info about the movement, especially in my region, I would be very grateful.

Thank you so much Princess Loona. I must say that I have been touched by your charm...

Congratulations to the whole team and a special tribute to the equally special charm of Princess Loona who had the ideas of our Beloved Prophet applauded at the famous 'Palais des Sports' in Paris... a beautiful premiere !

## First Sunday of April in Italy

To celebrate the creation of the first Human beings by our Creators on Earth, about 70 people from Italy gathered in a hotel in Rimini from Friday the 30th to Sunday April 1st.

Even if the weather was not too good, the room was full of light and warmth and our Bishop-Guides Marco and Ezael as well as our Guides Shirley, Roberta, Giovanni and Elena took us by the hand for a moving trip towards the discovery of serenity, the theme of our meeting.

After sharing the joy to be together, the teachings started with Giovanni who explained how to love oneself is the basis for a fully serene life, serene with oneself and serene with others. Then Marco and Ezael helped us to determine the biggest enemy of our serenity which is fear, an emotion that is intelligently nurtured in our society. They explained how the messages have been given to us as an antidote to this negative which prevents us from blossoming. Shirley talked about the humility that should support us philosophically like wings support the flight of a bird.

Finally Marco, our National Guide, charmed us with his words projecting us to a future that many cannot imagine yet but that is being prepared by our scientists today, using a video which illustrated the different steps we will face soon.

On Sunday, we talked about our diffusion activities, Leonardo talked about Intelligent Design. Leo joined us very recently and his enthusiasm and communication skills are very contagious ☺



Gianluca Russotto presented a Power Point presentation about Clitoraid which we will use next, Italy has collected 9,985 euro!!! Congratulations (15 euro short from their goal for the year as Clitoraid will have been in operation for a year really soon)

In the afternoon, two human beings had their cellular plan transmitted... welcome to you both!

It was then very difficult to leave each other, the love and harmony was so present we could almost touch it. There is no better way to pay a tribute to our Creators than to do what we are made for, that is to love and to love without limits.

Thank you Beloved Prophet for teaching it to us and for showing it to us everyday in your life.



## Montréal: Balance and Happiness

*By Samantha*

These two very simple and powerful words express something essential to every human being. Several factors contribute to our balance and happiness: meditation, sleep, stretching and food are amongst a few of them.

During our last meeting in Montreal, Emmanuel Comte, a music-therapist, explained that wisdom means to be balanced in one's brain. Our senses feed our brain and the more we tune our senses, the more we strengthen the capacity of our brain to balance itself. The first goal of meditation is to be in harmony with the Universe thanks to our senses, to refine what links us with what we are: the infinite. Music is composed of vibrations which are the expression of movements. These vibrational waves, in the form of sinusoid curves, bring polarities that are permanently changing.

To meditate on the essence of the vibrations enables us to get ourselves in harmony with these out-of balance continuously compensated which are source of balance. We are made of sounds. Music which is itself made of vibrations has the capacity to be in resonance with our internal tuning. This resonance state can influence the vibrations of our body, act on our balance and our internal movements.

France Blais (psychologist) helped us in regard with some current wrong beliefs about sleep. She explained that our sleep is made of a deep sleep which occurs in the first part of our night and a lighter sleep that is usually at the end of the night. Whatever the time at which you go to bed, you will face the same sleep phases. What matters is to sleep the number of hours one needs and this number varies from one individual to another and even for one individual, it varies from one day to the next. Sometimes we are very active so we need more sleep than if we had spent the whole day sitting in front of television. We also have to be careful not to go to extreme like sleeping too much or sleeping not enough. The goal is to be balanced.

Often when someone doesn't sleep well, it can be linked to activities or events which happened during the day like the food that person ate before going to bed (for example to eat a chocolate cake or to drink alcohol may disturb the sleep) or a flu. Some may have disturbed sleep because of some worries they have or for a lack of sport. Our sleep needs to be prepared and it plays an important role in our balance. We must listen to our body and be aware that if we sleep bad it means that something is wrong in our day to day activity. It is up to us to get hold of it and to make the changes using the teachings of our Beloved Prophet.



Francesco (specialist in Chinese medicine) also reminded us of the words of our Beloved Prophet regarding the mutual influence of our body and our brain and on how we can use it to recreate and maintain our balance, taking for example the time to stretch or modify our posture.



Then Daniel Chabot, our wonderful planetary responsible for teaching, shared a few words on the same theme. He explained that there is another element that is essential for our balance and our happiness which is the philosophical balance. The philosophical balance is fundamental as it gives a sense to our life and to our actions. Our society stresses the material aspect of our life – as we could see during the last election in Quebec- there is no message of hope, no dream.

Our philosophy gives this dimension through the dream to welcome the Elohim and to live in a world of peace and love. It invites us also to enter actions that are bigger than us and our day to day life. When people don't find this spiritual balance, they create illusion to try to fill the void that pushes them to boredom. It is then important to go back to our philosophical balance. The human being needs spirituality and he suffers when it is absent. In our society, this need is often negated and disparaged, when you do so, you also disparage a part of your balance. For us, Raelians, we have to go back to that, to this extraordinary dimension that is given by the messages as dreams and direction.

Samantha



## GPI promotion in Geneva

It was a world premiere and a great laugh for once!

We have started to awaken consciousness about ways to save our planet from pollution. It was more than a promotional campaign, it was an Elohimeditation that we have started. This is a big and beautiful dream which brings laughter, taking little risk, the risk to be amongst those who assist our beloved Prophet in making this planet an exceptional place of leisure for Eternals. Geneva was full of sun on that Saturday and we brought our colors so that the city can be a rainbow of love and consciousness.



After a few moments spent talking with an impulsive young man, we decided to walk away; it is then that he said "I'd like to shake your hand as you are great people, but Rael isn't!" We laughed so much that day!

To end with a climax, we had a visit from the police, proving once more that wanting to bring order and harmony disturbs the established disorder! "You don't have the right to march, stop this manifestation, I will write a ticket, who is the leader?" Albert presents himself and the Raelians around protested and defended him invoking Human Rights.

The policemen then asked to remove the posters they were wearing and the banner. However Albert kept his and told the policemen: "do your job, make sure you do your duty and add my name to your file". Then Albert went around the whole place giving pamphlets and the policemen didn't ask him to remove his butterfly wings! What a pleasure and what a good laugh we have with this determination. 0% resistance of the police and 100% consciousness.

Congratulations to the whole team. Thanks to Roger Geoffroy for the colorful butterfly wings, Agnes Burdal for the banner, Annie Rouyer for the accessories, hats, scarves... and Jean Michel Saunier for his support in all our diffusions !

Albert SCHANZENBACHER,

*Responsible for the GPI Promotion in France*

## CHICAGO, USA: A Spanish Lecture

I Just wanted to let you to know that our Spanish lecture was a huge success. There were between 40-50 individuals that came out and heard the presentation given by Eduardo, Alfredo, Adal, and Martin. After the initial video introduction, the four of them stood in front of the group to answer questions like a panel would do. I thought that they did a magnificent job. They were forced to go beyond the allotted time trying to answer all of the inquiries and the discussions went on even after we had to leave the lecture hall. The team sold several books and passed out numerous fliers, also. Looking forward to seeing all of you soon in Palm Springs .

Have you made plans for the Continental seminar in Palms Springs yet?

Love,

*Larry*

## Miami, USA: Clitoraid Fundraiser

The Miami team took South Beach by storm and raised a whopping \$1800.00 in one evening for Clitoraid. The angels(Angels) charmed the crowd with a sexy lingerie fashion show organized by Estelle Levesque and a few non Raelian(non-Raelian) girls joined us. They were so moved by what is happening to the women of Africa that they asked if they could help us. As you can see from the pictures everyone had a wonderful time and the sexy Lisa and Raquel rocked the house. The local store owners and restaurants donated gift certificates as well as local artists and the hotel donated a 2 night's stay valued at \$350.00, gave us 20% of(off) the bar proceeds of the night, paid for the advertisements, bought the balloons, donated the food and drinks, and we collected the \$25.00 entrance fee. People were so kind and the ones who impressed me the most were the people who just wandered in off the street and had no idea of what was going on. When they heard about Clitoraid and what the money was going to, opened their hearts and pockets and gave without question. What a privilege it is to be a part of the Raelian Movement and thank you Rael from the bottom of our hearts for being the brightest light leading the way for a new and better world.

Love,

Donna



# Beautiful Articles

## A Fractal Universe?

*Robert L. Oldershaw*

*Geology Department*

*Amherst College (Box 2262)*

*Amherst, MA 01002*

*roldershaw@amherst.edu*

**ABSTRACT: From subatomic particles to superclusters of galaxies, nature has a nested hierarchical organization. There are also suggestive hints that self-similarity, the idea of similar form on different size scales, might be a fundamental property of the cosmological hierarchy. These features are the hallmarks of fractal structure. Could nature, as a whole, be a fractal system?**

By now everyone with an interest in science or computers has stared in wonder at pictorial representations of the amazing fractal called the Mandelbrot set. If you are one of the few remaining holdouts, then do yourself a favor and explore the full color illustrations of this infinite mathematical labyrinth (one readily available source is James Gleick's popular book *Chaos*<sup>1</sup>). These images, depicting seemingly endless layers of complexity and geometric inventiveness, strike deep intellectual and emotional chords. A large part of the magic is due to the fact that as you plunge deeper into the Mandelbrot set you encounter ever-more-tiny copies of itself within the riot of detail. This "worlds within worlds" aspect, or self-similarity, calls to mind the famous poem of William Blake:

*"To see a World in a Grain of Sand...*

*And a Heaven in a Wild Flower*

*Hold Infinity in the Palm of your hand*

*And Eternity in an hour."*

A truly remarkable thing about the Mandelbrot set is that it is not generated by long strings of incomprehensible equations, but rather by a simple recursive algorithm that can be embodied in a few lines of computer code. So the seemingly infinite complexity of the Mandelbrot set has a simple underlying order. Here one is reminded of Coleridge and his "unity in variety." Using this fractal as an archetype, one can say that two hallmarks of fractal systems are: (1) inherent hierarchical organization, and (2) self-similarity, i.e., the copies within copies within...motif.

Another notable example of a fractal structure<sup>2</sup> was presented by E.E. Fournier d'Albe in 1907, long before the current wave of interest in self-similarity. On the largest scale, Fournier's fractal is a "snowflake" made up of 5 parts. But each of these parts is a miniature copy of that "snowflake," and these miniature copies are in turn composed of still smaller "snowflakes," and so on in an infinite hierarchical series. Fournier also had his readers imagine the fractal continuing

infinitely to ever-larger "snowflakes." This fractal structure is simple (only one shape is involved) and very regular ("snowflakes" at different scales are separated by a constant scale factor of 1/7), but again the mind tends to find its boundless self-similarity intriguing.

Fractals are not limited to the realms of mathematics and computer graphics, but rather abound nearly everywhere you look in nature. Tree branching, cloud structures, galaxy clustering, fern shapes, the veins of human and leaf, music, coastlines, fluid turbulence, crystal growth patterns, and very much more, involve self-similarity. Given that self-similar structure is ubiquitous within segments of the cosmological hierarchy, it is surprising that little attention has been given to the possibility that nature as a whole might be a fractal system. Let us explore this unorthodox but reasonable idea.

## COSMOLOGICAL SELF-SIMILARITY

The cosmos certainly has the first hallmark of a fractal system: nested hierarchical organization. From elementary particles to superclusters of galaxies we see parts collected to form "wholes" and the latter collected into larger "wholes," and so on. This hierarchical organization is remarkably stratified, which means that a few classes of objects populating limited segments of the hierarchy dominate in terms of mass and numbers. For example, virtually all observable mass is locked up in atoms (neutral and ionized states). Virtually all of this mass is, in turn, lumped into stars, and virtually all stars are collected into galaxies. In between atomic scale objects and stellar scale objects there are many interesting classes of objects, including ourselves, but they are quite rare relative to the dominant classes of objects. So, to a first approximation, the portion of nature that can be directly observed is organized into a discrete hierarchy: ... which are composed of galaxies, which are composed of stars, which are composed of atoms, which are....

The more difficult question is whether nature's hierarchy manifests a physically meaningful degree of self-similarity. Certainly we would not expect to find the exact self-similarity seen in Fournier's fractal. But, for all their apparent differences, might not atomic, stellar and galactic systems be more self-similar than is currently thought? Einstein once commented: "It has often happened in physics that an essential advance was achieved by carrying out a consistent analogy between apparently unrelated phenomena."<sup>3</sup> Let us pursue this slightly unorthodox line of thought and see where it leads us. We begin by looking for regular scaling relationships that would be indicative of self-similarity.

Given the strong stratification of the cosmological hierarchy, one at least has a very rudimentary self-similar organization: galactic "particles" are composed of stellar "particles", which are composed of atomic "particles." However, this essay proposes that there are more meaningful scaling relations among these "particles" that populate such enormously different size scales. Atoms have radii on the order of  $10^{-8}$  cm while the typical radius for a star would be  $5 \times 10^9$  cm. So we adopt  $5 \times 10^{17}$  as our tentative scaling factor for lengths, and call it  $K$ . Since space and time are treated nearly equivalently in relativistic physics, it will be assumed tentatively that  $K$  is also the appropriate scale factor for temporal "lengths."

A promising place to begin the search for self-similarity would be with the well-known analogy between atomic nuclei and neutron stars. In fact the latter have often been likened to "gigantic atomic nuclei." Atomic nuclei typically have radii on the order of  $10^{-12}$  cm and multiplying that value by  $K$  gives an estimate on the order of 5 km for neutron star radii. Since neutron stars are believed to have radii of roughly 10 km, the first test of our approximate scaling relation is encouraging. Classical spin periods for atomic nuclei are on the order of  $10^{-19}$  sec to  $10^{-20}$  sec. Scaling these values by  $K$  gives expected spin periods for neutron stars on the order of  $10^{-2}$  sec to  $10^{-1}$  sec, which are nicely within the observed range of typical spin periods for neutron stars:  $10^{-3}$  sec to 100 sec. Atomic nuclei also undergo vibrational oscillations with periods of roughly  $10^{-22}$  sec to  $10^{-21}$  sec. Do neutron stars oscillate with periods that are about  $K$  times longer? In fact, observed neutron star oscillations are in the range of  $10^{-4}$  sec to  $10^{-3}$  sec, which is in good

agreement with our expectations.<sup>4</sup> So for the case of atomic nuclei and neutron stars we find a fairly reasonable degree of self-similarity between the proposed analogues. Both involve extremely dense and rapidly spinning objects whose radii, rotational periods and oscillation periods scale by a factor of  $K$ , as expected.

An important question is whether or not the scale factor  $K$  will continue to hold good for extensions to the galactic scale. Galaxies have "peculiar velocities" (random motions in addition to the general Hubble expansion) that average roughly 400 km/sec. Since the galactic "particles" are undergoing such enormously energetic random motions, the only reasonable atomic scale analogues would be fully ionized atomic particles, i.e., nuclei or electrons. Since galaxies are clearly extended objects with considerable substructure, electrons are ruled out as potential analogues. If we scale our nuclear radius (about 10-12 cm) by  $K^2$  (since we are "going up" two scales), we get a predicted radius on the order of 10<sup>23</sup> cm for a typical galaxy. Again this is correct; galactic radii typically are on the order of 10<sup>22</sup> cm to 10<sup>23</sup> cm. Moreover, if we scale typical nuclear spin periods by  $K^2$ , we get the correct order of magnitude for galactic spin periods: on the order of 10<sup>8</sup> years.

Bearing in mind that self-similarity need not be exact, and that analogues from different scales are not expected to be exact copies, let us return to the comparison between atoms and stars. Atomic radii range from about 10<sup>-9</sup> cm for the ground state of small atoms to 10<sup>-4</sup> cm for very highly excited Rydberg atoms. Scaling by  $K$ , we would expect most stars to have radii ranging roughly from 10<sup>9</sup> cm to 10<sup>14</sup> cm. This is in fact the case; dwarf stars typically have radii on the order of 10<sup>9</sup> cm and supergiant stars have radii of up to 10<sup>14</sup> cm. Excited atoms can act like tiny oscillators and a typical range for the periods of their oscillations would be 10<sup>-16</sup> sec to 10<sup>-10</sup> sec. Do stars undergo colossal oscillations with periods  $K$  times longer? Remarkably enough, yes; many stars go through phases in which they become variable stars. Such stars are characterized by regular pulsations with periods ranging from minutes to years, in good agreement with the anticipated self-similar scaling. And even "constant" stars like the Sun tend to have regular oscillations in this range, though of smaller amplitude.

Many who hear the foregoing evidence for cosmological self-similarity initially underestimate the restrictiveness of the model. They feel that one could choose other analogue pairs and/or different scaling relations and come up with an equally defensible model. If you think that this is possible, then I urge you to get out paper and pencil and actually try this experiment. Having considerable experience in exploring these matters, I think that you will be surprised at the uniqueness of the analogue and scaling results discussed above. In other models, the scaling relations get inadmissibly complicated and/or the derived analogue pairs do not match morphologically or kinematically. But do not take my word for it; try it yourself.

The major components constituting 99.99% of the observable universe: nuclei, atoms, compact stars, main sequence stars and galaxies, have several basic properties that are consistent with the hypothesis of discrete self-similar scaling characterized by the scaling factor  $K$ . Are there further hints that this apparent self-similarity might be a fundamental, but hitherto unappreciated, symmetry principle of nature? Indeed there are a few more. A two-part paper by the present author offers a more detailed review of the evidence for discrete cosmological self-similarity. <sup>4</sup> Therein it is shown that the magnetic dipole moments of atomic nuclei and neutron stars are related by the proposed self-similar scaling rules. In the same category, there is a correlation between the angular momentum ( $j$ ) of an atom and its magnetic dipole moment ( $u$ ). Stars have a corresponding correlation between their  $J$  and  $U$  values, and the proportionality constant ( $d$ ) that relates  $U/J$  and  $u/j$  is in agreement with the value predicted by the fractal scaling rules. In a related example, the angular momenta of stars ( $J$ ) and atoms ( $j$ ) are both related to their respective mass values ( $M, m$ ). Again the proportionality constant ( $k$ ) that relates  $J/M^2$  and  $j/m^2$  is in agreement with the value predicted by the self-similar scaling. Other supporting, though more circumstantial, pieces of evidence include the well-known analogy between stellar scale and galactic scale jet phenomena, and the intriguing rotational spin-up (or "glitch") phenomena that is seen in both atomic nuclei and neutron stars. The author's review paper<sup>4</sup> presents a total of 19 quantitative examples of self-similar scaling.

When astronomers recently discovered that the pulsar PSR 1257+12 was orbited by two planets, they were quite surprised since such a system had previously been considered a virtual impossibility. On the other hand, pulsar-planet systems were anticipated by the self-similar cosmological model several years before this discovery.<sup>5</sup>

Although the idea of comparing atoms and stellar systems is repugnant to many, probably owing to the demise of Bohr's first planetary model of the low energy state atom (for which he won the Nobel prize), consider the following description of a very high energy state Rydberg atom: "an ion core and an isolated electron very far away, floating lazily around in a slow orbit, much like a distant planet of the Solar System."<sup>6</sup> The atomic nucleus/galaxy analogy finds further support in two recent findings: that galaxies appear to have "quantized" redshifts,<sup>7</sup> and that the statistics of galaxy clustering bear a notable resemblance to results derived for subatomic particles.<sup>8</sup> It can also be noted that galaxies and atomic nuclei share the same basic spherical, oblate and prolate shapes. Prolate shapes, discovered in nuclei and in galaxies only within recent decades, came as twin surprises to physicists.

Bearing in mind that physically meaningful self-similarity does not require analogues on different scales to be exact replicas, but only to be similar in shape and motion, and related by consistent scaling relations, the case for discrete cosmological self-similarity looks reasonably promising.

## THE CRUCIAL EXPERIMENT

I could understand a skeptic saying: "Well, these correlations are provocative, but could it not be attributed to a combination of coincidence and fortuitous choices of analogues?" I would respond that the analogue choices are not arbitrary; they are self-consistent and constrained in shape, size and motion. It also seems rather unlikely that we keep getting correct results by chance, especially when we are jumping around by such outrageously large scale factors. I think that it is more reasonable, and more scientific, to suspect that we are seeing evidence for some form of cosmological self-similarity. What we really need, however, is a dramatic and unambiguous test of the idea that the cosmos has a discrete fractal organization. Happily such a test has been identified, the initial experimental results are in, and definitive results will soon be available.

The atomic scale is mostly populated by unbound protons and electrons; they are at least 10 times more abundant than other atomic systems. If the cosmological self-similarity hypothesis is valid, then the stellar scale would be similarly dominated by two analogous classes of objects. The author's more detailed review paper<sup>4</sup> predicts that these analogues must be ultra-compact objects (black holes) with masses of about  $7 \times 10^{-5}$  solar masses for the stellar scale electron analogues and about 0.145 solar masses for the stellar scale proton analogues. Galaxies should be teeming with these objects, but their "blackness" would make them very difficult to observe directly. On the observational front, it is known with a high degree of confidence that some mysterious population of "dark matter" objects does indeed dominate the masses of galaxies by at least a factor of 10. So the hypothesis of discrete cosmological self-similarity leads naturally and unequivocally to the prediction that the observed, but enigmatic, dark matter is primarily composed of our predicted proton and electron analogues.

In the summer of 1992 a very important experiment, conducted by a collaboration of American and Australian scientists, began to search for stellar scale dark matter objects.<sup>9</sup> This research group, referred to as the MACHO (Massive Compact Halo Object) collaboration, is using an Australian telescope to monitor millions of stars in the Magellenic Cloud galaxies in the hope of detecting gravitational microlensing events caused by stellar scale dark matter objects in the halo and bulge of our galaxy. If the mystery objects have masses in the range of  $10^{-6}$  solar masses to 102 solar masses, then they will cause distinctive brightening of distant stars via gravitational microlensing. The numbers, durations and amplitudes of the events can then be used to determine the mass spectrum of the dark matter objects. Two other teams, the European EROS collaboration and the American-Polish OGLE collaboration, are currently

conducting similar experiments and therefore any results can be independently cross-checked. At least two other groups (the DUO and AGAPE collaborations) are preparing for additional microlensing experiments.

The first two reported microlensing events came from a slightly different type of experiment in which distant quasars are microlensed by objects in intervening galaxies. Two research groups conducting these experiments have identified microlensing events, and estimated lens masses of about  $5.5 \times 10^{-5}$  solar masses in one case<sup>10</sup> and about 0.1 solar masses in the other case.<sup>11</sup> These estimates have large error bars, but it is remarkable how close those first tentative results are to our predicted masses of  $7 \times 10^{-5}$  solar masses and 0.145 solar masses.

Then the MACHO collaboration recorded a major event with the classic signatures of microlensing.<sup>12</sup> The source star in the LMC brightened by 2 magnitudes, about a factor of 7, and then faded to its normal luminosity in a time symmetric and achromatic manner. The MACHO group derived a best fit lens mass of 0.12 solar masses, which is statistically indistinguishable from our prediction of 0.145 solar masses. The EROS group reported two further microlensing events and, when a method of mass moments analysis was applied to the MACHO and EROS data, a mass peak at 0.144 solar masses was derived.<sup>13</sup> As of this writing more than 100 candidate events, mostly involving microlensing of sources in our galaxy's bulge by intervening objects, have been reported. The general consensus is that the main mass peak for the halo MACHOs recorded so far is on the order of 0.1 solar masses, although we are still dealing with low number statistics. At this writing no additional planet-sized microlenses have been identified, but when the predicted abundance of these objects is considered, none would have been expected yet. Given a sufficiently long observation program, planetary-mass MACHOs should be seen and the full dark matter mass spectrum should be revealed. The definitive predictions of main peaks at  $7 \times 10^{-5}$  solar masses and 0.145 solar masses, singled out from a mass range that extends over 70 orders of magnitude (from  $10^{-64}$  solar masses to 107 solar masses), will have been unambiguously verified or falsified.

One other prediction that appears to have been verified is the strict requirement that just below the 0.15 solar mass peak there must be a sharp cutoff in the number of stellar scale objects, just as the atomic scale mass spectrum has a sharp cutoff just below the proton mass. New observational results, much to the surprise of astrophysicists, appear to have confirmed this unique cutoff at the predicted value.<sup>15,16</sup> Particularly definitive is the low-mass cutoff for microlensing events (now more than 100) observed in the galactic bulge.<sup>17</sup>

## POSSIBLE IMPLICATIONS OF COSMOLOGICAL SELF-SIMILARITY

If the dark matter is composed of ultra-compact stellar scale objects with a mass spectrum that is approximated by predictions of the self-similar hypothesis, then it would appear that discrete self-similarity is a newly identified global property of nature. This would certainly change our current understanding of the cosmos. Firstly it would provide a new approach toward a more unified understanding of nature, since cosmological self-similarity implies analogous physics on all observable scales. It would also imply that the usual assumption that the universal hierarchy has cutoffs at about our current observational limits, an assumption that has always seemed suspiciously anthropocentric, should be questioned. If cosmological self-similarity is verified, then it would seem more likely that additional scales underlie the atomic scale and encompass the galactic scale. According to the new paradigm the Big Bang does not involve the expansion of the entire universe, but rather just one metagalactic object with dimensions far exceeding our current observational limits. Also, a new fractal geometry of space-time-matter would appear to be called for.

The self-similar cosmological paradigm does not throw out well-tested fundamental physics such as quantum mechanics, general relativity or even the Big Bang approximation. Instead it views most of the current theories of atomic physics, stellar astronomy and cosmology as valuable approximations that can now be reinterpreted, refined and incorporated within the broader and more unified context of an unbounded fractal cosmos.

If microlensing experiments verify the unique predictions mentioned above, however, we would still be faced with some important and very difficult questions. How many scales are there in all, a finite number or "worlds within worlds" without end? How strong is the degree of self-similarity between analogues? Why is nature self-similar, and why are scales separated by a factor of about  $5 \times 10^{17}$ ? Like past discoveries, this one too would come wrapped in enigmas.

Some might argue that the self-similar cosmological paradigm is too fantastic to be true, that it is too speculative to deserve serious attention. But is it more fantastic or speculative than Alice In Wonderland theories like cosmic strings, shadow matter, Higgs bosons, the "many worlds" interpretation of quantum mechanics, etc. Probably not, if judged objectively, and at least the self-similar model can make definitive predictions and point to actual observational support. It is possible that nature really does involve the "worlds within worlds" structure of a fractal system. Certainly there is enough supporting evidence to warrant serious consideration of discrete cosmological self-similarity. And soon, via microlensing experiments, we will learn nature's own verdict on this hypothesis.

## REFERENCES

1. J. Gleik, *Chaos* (Viking, 1987).
2. B. B. Mandelbrot, *The Fractal Geometry of Nature* (W. H. Freeman, 1983).
3. A. Einstein and L. Infeld, *The Evolution of Physics* (Simon and Schuster, 1938), p. 270.
4. R. L. Oldershaw, *Internat. J. Theor. Phys.* 28, 669 and 28, 1503 (1989).
5. R. L. Oldershaw, *Spec. Sci. Tech.* 16, 319 (1993).
6. H. J. Metcalf, *Nature* 284, 127 (1980).
7. B. Guthrie and W. M. Napier, *Mon. Not Roy. Astron. Soc.* 253, 533 (1991).
8. P. Carruthers, *Astrophys. J.* 380, 24 (1991).
9. C. Alcock, T. Axelrod and H. S. Park, *Bull. Amer. Astron. Soc.* 21, 1149 (1989).
10. R. L. Webster, A. M. N. Ferguson, R. T. Corrigan and M. J. Irwin, *Astron. J.* 102, 1939 (1991).
11. F. Flam, *Science* 256, 31 (1992).
12. C. Alcock, et al, *Nature* 365, 621 (1993).
13. P. Jetzer and E. Masso, *Phys. Lett. B* 323, 347 (1994).
14. F. De Paolis, G. Ingrosso, P. Jetzer and Roncadelli, *Phys. Rev. Lett.* 74, 14 (1995).
15. J Travis, *Science* 266, 1319 (1994).
16. R. L. Oldershaw, *Internat. J. Theor. Phys.*, in press (1996).
17. C. Alcock, et. al., *Astrophys. J.*, in press (1996).

# Could black holes be portals to other universes?

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*David Shiga*

The objects scientists think are black holes could instead be wormholes leading to other universes, a new study says. If so, it would help resolve a quantum conundrum known as the black hole information paradox, but critics say it would also raise new problems, such as how the wormholes would form in the first place.

A black hole is an object with such a powerful gravitational field that nothing, not even light, can escape it if it strays within a boundary known as the event horizon. Einstein's theory of general relativity says black holes should form whenever matter is squeezed into a small enough space.

Though black holes are not seen directly, astronomers have identified many objects that appear to be black holes based on observations of how matter swirls around them.

But physicists Thibault Damour of the Institut des Hautes Etudes Scientifiques in Bures-sur-Yvette, France, and Sergey Solodukhin of International University Bremen in Germany now say that these objects could be structures called wormholes instead.

Wormholes are warps in the fabric of space-time that connect one place to another. If you imagine the universe as a two-dimensional sheet, you can picture a wormhole as a "throat" connecting our sheet to another one. In this scenario, the other sheet could be a universe of its own, with its own stars, galaxies and planets.

Damour and Solodukhin studied what such a wormhole might look like, and were surprised to discover that it would mimic a black hole so well that it would be virtually impossible to tell the difference.

## Hawking radiation

Matter would swirl around a wormhole in the same way as for a black hole, since both objects distort the space around them in the same way.

One might hope to distinguish the two by something called Hawking radiation, an emission of particles and light which should only come from black holes and would have a characteristic energy spectrum. But this radiation is so weak that it would be completely swamped by other sources, such as the background glow of microwaves left over from the big bang, making it unobservable in practice.

Another difference one might hope to exploit is that unlike black holes, wormholes have no event horizon. This means that things could go in a wormhole and come back out again. In fact, theorists say one variety of wormhole wraps back onto itself, so that it leads not to another universe, but back to its own entrance.

## Daring plunge

But this does not provide a foolproof test either. Depending on the detailed shape of the wormhole, it could take billions of years or more for things to pop back out after falling in. With the right shape, even the oldest wormholes in our universe would not have had time to spit anything back out yet.

It seems the only way to decide the issue for sure with astronomical black holes is to make a daring plunge inside. That would be a dangerous gamble, because if it is a black hole, the incredibly strong gravitational field inside would tear apart every atom in your body. Even if it turns out to be a wormhole, the forces inside could still be deadly.

Assuming you could survive, and the wormhole was not symmetric, you might find yourself in another universe on the other side. Without further intervention, the wormhole would tend to suck you back in and carry you back to the opening in your universe.

## Yo-yo motion

"The spaceship would do this yo-yo motion," Damour told New Scientist. "[But] if you use your fuel, then you can escape from the attracting power of the wormhole and explore" the space on the other side, he says.

But a friend in either universe might have to wait billions of years to hear back from you, since the transit time could be excruciatingly long.

Such a delay would make meaningful communication with anyone on the other side impossible. But the delay gets smaller with smaller wormholes. If a microscopic wormhole could be found or constructed, the delay across it could be as short as a few seconds, Solodukhin says, potentially making two-way communication possible.

Stephen Hsu of the University of Oregon in Eugene, US, who has studied the formation of black holes and the properties of wormholes, says he agrees that distinguishing between the two types of object with observations is practically impossible, at least with current technology.

## Exotic matter

"The most important property of a black hole – that there is a 'point of no return' for an object falling in – is not something we can test at the moment," he told New Scientist.

Still, he says the objects out there suspected to be black holes probably really are black holes rather than wormholes. There are plausible scenarios for forming black holes, he says, such as the collapse of a massive star, but it is not clear how you would form a wormhole.

"Wormholes that might be confused with a macroscopic black hole require some kind of exotic matter to stabilise them, and it is not known whether such exotic matter exists," he says.

Solodukhin says that a wormhole might form in much the same way that black holes form, such as from a collapsing star. Physicists normally expect in these situations that a black hole would be produced, but Solodukhin says that quantum effects may stop the collapse just short of producing a black hole, leading to a wormhole instead.

## Microscopic black holes

He says this mechanism might be inevitable in a more complete picture of physics that unites gravity and quantum mechanics – a longstanding goal of physics. If he is right, then wherever we used to expect black holes to form, wormholes would form instead.

And there might be a way to test the conjecture. Some physicists say that future particle accelerator experiments could produce microscopic black holes (see [Atom smasher may give birth to 'Black Saturns'](#)).

Such tiny black holes would emit measurable amounts of Hawking radiation, proving that they are black holes rather than wormholes. But if Solodukhin is right, and microscopic wormholes are formed instead, no such radiation would be expected. "In that case, you would actually see if it is a black hole or a wormhole," he says.

An added benefit of wormholes is that they could resolve the so-called black hole information paradox. The only way anything can exit a black hole is in the form of Hawking radiation, but it is not clear how the radiation carries information about the original object that was swallowed. This scrambling effect conflicts with quantum mechanics, which forbids such erasing of information (see [Black holes: The ultimate quantum computers?](#)).

"Theoretically, wormholes are much better than black holes because all these problems with information loss don't exist in this case," Solodukhin says. Since wormholes have no event horizons, things are free to leave without first being converted into Hawking radiation.