

MAGAZINE SECONDS

SECONDS #26, 1994 • interview by George Petros

Dr. Fiorella Terenzi



Tune in with the luscious astrophysicist DOCTOR FIORELLA TEREZI to the coolest radio station from outer space, originating in the galaxy UGC 6697 (“UGC” stands for Universal Galactic Catalog). UGC 6697 is an irregular spiral galaxy, accompanied by a smaller companion galaxy, located about 180,000,000 light-years from Earth. UGC 6697 and its orbiting companion share a cloud of ionized gas. Violent interactions between these galaxies trigger very high rates of star formation. The UGC 6697 system is one of the most powerful radio sources in the universe.

Within the torrent of incoherent incoming intergalactic information, Fiorella identified frequencies and intensities of waveforms in which she heard rhythm, and from there it was just a matter of groovin’ with the galactic vibrations as if they were any other form of electronic impulses fed into a synthesizer and summoned up as music. To produce the ultimate ambient vibe, Fiorella literally played the galaxy UGC 6697. Its intensity can now soothe us after a hard day listening to retro rap rock radio bullshit — making this one of the most powerful releases I’ve ever had — I mean, heard.

“There is a strong analogy between cosmic noise and music.”

SECONDS: *Are the rhythms of the universe reflected in the biological rhythms of the human body?*

TERENZI: In a way, I would say yes. I don't know what exactly the relationship is. Scientifically speaking, it looks like there is some effect the planets have on our systems, on our bodies, and on our minds. The sun, for instance — we have a solar wind that interferes not only with our radios, but also with our bodies. We are regulated by the moon in the same manner. Jupiter — there are some strong magnetic storms generated there. Particles coming through the deep universe reach Planet Earth and we study these particles and we understand the modern universe.

SECONDS: *Is there an equivalent wave form for these biological and electromagnetic rhythms?*

TERENZI: I can answer you scientifically and from a personal point of view. Scientifically, there is a reflection. I don't know if you'd call it rhythm or symmetry, but there is a reflection between our solar system and atoms. We have electrons orbiting around the nucleus and we have planets orbiting around the sun, so there is some symmetry that is reflecting in our micro little world. Now if we're talking about some other kind of rhythm, I don't know — maybe yes, maybe no. Maybe time can be a rhythm. The deeper you can go into matter, into the particle, the more far out you go in the universe.

SECONDS: *So maybe the heartbeat is the same rhythm as a pulsar, on a different scale?*

TERENZI: On a different scale.

SECONDS: *Maybe the same thing makes both beat.*

TERENZI: Well, yes, the universe runs on a heartbeat. Take a pulsar, for instance. Maybe it's a different periodicity, different intervals of time, but it's still similar to a human heart.

SECONDS: *In a nutshell, what is the nature of the electromagnetic radiation which fills the universe?*

TERENZI: It's mostly caused by the acceleration and collision of particles. So when protons, electrons, and simple molecules travel the universe, they accelerate in the presence of a gravitational and magnetic field. There is an emission of electromagnetic waves which we receive

on Earth and from that we analyze the universe. From very little we get so much.

SECONDS: *What celestial phenomena generate radio waves?*

TERENZI: Radio waves are generated by particle acceleration and particle collision. So it's the same phenomenon — the electromagnetic spectrum is always the same phenomenon.

SECONDS: *Are radio sources in the universe generally within galaxies that have collided?*

TERENZI: One of the objects that emit radio waves in the universe is a radio galaxy — very faraway objects. The radio objects sometimes are very mysterious. If you look with your eyes at the universe, you don't see anything — and then when you look with the radio telescope you see big nebulae, big explosions. So radio objects are very intriguing. Sometimes the radio objects are the same things as the visual objects. Most of the radio objects are invisible. You can scan the universe with your eyes and not see anything, but then when you tune in on a radio frequency — in gigahertz — a complete universe comes out.

SECONDS: *That's because the wavelengths of radio waves are so long, and can travel through dust and gas clouds.*

TERENZI: Yes.

SECONDS: *Now how big are some of the big wavelengths?*

TERENZI: A kilometer.

SECONDS: *Are radio waves affected by the dust and gas that hinders the travel of light?*

TERENZI: The dust particles are very small. They trap the light because the wavelength of light is similar to the size of the dust particles, and in these cases we have what we call absorption nebulae. The dust is not able to absorb the larger radio waves. I think an advantage of radio waves is that we are able to receive them on Earth, because the atmosphere does not absorb them. So we are lucky. Still, there are some microwave, X-ray and infra-red observations for which it is very useful to be able to go outside our atmosphere.

SECONDS: *Could you give us a brief history of radio astronomy?*

TERENZI: Radio astronomy started around 1933. The most well-known researcher in radio astronomy was Karl Jansky. He was working on some kind of radio noise generated somewhere he couldn't locate. He

Dr. FIORELLA TARENZI

was working with radio communication between Europe and America, so he was working with headphones most of the time, checking out the signals, and all the time he was hearing some strange background noise. He was thinking, “where did it come from?” So he started to analyze and found that the ghost radio station emitting these noises was changing with the seasons, and was not located on Planet Earth. It was in the Milky Way, the center of our galaxy. That opened up a new field of research.

SECONDS: *What’s the primary function of radio astronomy?*

TERENZI: The primary function of radio astronomy is to analyze and to study the universe by means of radio telescopes and to derive chemical and physical information.

SECONDS: *For your CD, how were cosmic signals collected?*

TERENZI: The radio waves were collected with radio telescopes, like the large one in New Mexico.

SECONDS: *How do radio telescopes work?*

TERENZI: Radio telescopes are big radio receivers. With the Very Large Array Radio Telescope, there are twenty-seven separate antennae — twenty-seven different radio telescopes. You use interferometry because you have twenty-seven different signals.

SECONDS: *What does interferometry do?*

TERENZI: It combines the outputs of two or more antennae.

SECONDS: *So it synchronizes two or more antennae?*

TERENZI: It synchronizes two or more antennae spread over great distances, effectively creating one large antenna.

SECONDS: *So you essentially use a radio receiver like the one a person would have at home?*

TERENZI: Yes. The receiver is a little bit different, and the antenna is like the satellite dishes you see for television — exactly the same but fifty times bigger.

SECONDS: *And millions of times more sensitive.*

TERENZI: Exactly.

SECONDS: *What is the relationship of celestial noise to earthly music?*

TERENZI: That’s an interesting question. For me, having converted these radio signals into sound using acoustic astronomy, there is a strong analogy between cosmic noise and music. Even in this strange galactic noise

I hear melody. There is a microtonality, so not only does cosmic noise speak to us as European music, but it also speaks to us as Indian and Arabic music. That is a source of inspiration.

SECONDS: *Within this noise, what is the physical basis of the changes in intensity?*

TERENZI: First, the radio waves are unique for each celestial object. Each spectrum is like a signature for a star, so we can catalog different stars. In the same way that you have a visible light spectrum, you should be able to obtain an acoustic spectrum — a unique signature. If you listen to plasma waves, they’re completely different from pulsars.

SECONDS: *So acoustic astronomy will allow each celestial object to have an acoustic signature. Were you the first to come up with that?*

TERENZI: Yes, it’s my technique. You need my software to do it. I did an alteration and extension of a program called cmusic by Professor Richard Moore at the University of California San Diego Computer Audio Research Laboratory.

SECONDS: *Intensity and frequency are the common denominators between galactic signals and music.*

TERENZI: I love your term “the common denominator.” It’s perfect. Listen to musical notes — you have intensity, which gives you a loud sound or a less loud sound, and you have frequency, which gives you pitch. We tune our musical instruments to the note A at 440 Hertz — 440 vibrations per seconds — and you can play that A very loud or very soft. It’s the same thing with galactic radiation. You have frequencies that are very, very high. As for intensity, some are weak, some are strong.

SECONDS: *What other types of electromagnetic radiation can be transformed into earthly music?*

TERENZI: I would say all of the electromagnetic functions, from gamma to X-ray to ultraviolet to infrared. You just need the technique. The gamma ray universe has been so little observed because our technology is limited. It’s only in the last six or seven years we’ve been able to do something significant, but still we don’t have any clue of what really is in the gamma universe. The more technology pushes against the barrier, the more we are able

“I think I’m going to be a galactic star — or maybe a galaxy.”

to go farther out in space — not only with the robot and satellite, but also with human exploration.

SECONDS: *Are you disappointed at the course human space exploration has taken?*

TERENZI: I’m disappointed because there is not much funding for human space exploration.

SECONDS: *Has the golden age of space exploration ended?*

TERENZI: As everything in life, it goes up and down. They were at a very high peak with the moon landing, and I know they are planning the Mars mission after 2000 or 2010. The recent NASA Space Shuttle mission for Hubble and the Mission To Planet Earth radar surveys were great successes and historical achievements.

SECONDS: *Is it frustrating to see money spent in other places while science languishes?*

TERENZI: America is still the top country for research. The universities are the best in the world. But I wish scientists and researchers could have more attention, not only from the politicians, but from everyday people. I would like to see space be more for the people — for everybody. Space is our property. I really hope to give back what human beings own — the universe. It’s ours.

SECONDS: *What’s your reaction going to be when you discover evidence of extraterrestrial intelligence?*

TERENZI: It would be mind-blowing. It would be very difficult to conceive — It’s something I hope for. The search for extra-terrestrial life is now known as SETI-HRMS, Search For Extra-Terrestrial Intelligence-High Resolution Microwave Survey. We have such a great system and we’re scanning the universe with high resolution on many channels. We’re looking for some sort of

contact. All the time, stay open. Do not shut down the channel.

SECONDS: *Why are some galaxies more active than others?*

TERENZI: It is very complex, and we do not understand it completely. But some of the variables are galaxies undergoing collision with another object or galaxy, star formation, possible black holes, the interstellar medium, and the age of the stellar population.

SECONDS: *To what other celestial objects do you hope to turn your attention?*

TERENZI: I hope to turn next to a pulsar, mostly because I need a cosmic drummer for my compositions. I would love to experience the sun, Jupiter, our solar system and some other radio galaxies.

SECONDS: *When you’re listening, do you like some signals more than others? Is it aesthetic at some point?*

TERENZI: From the analytical point of view, what I look for is

repetition. I watch the visual presentation and I try to corollate it with the acoustic representation. From the creative point of view, I sing along. I sit at the piano and play along and all the time I play I have the computer recording what I’m playing. I try to imitate the galaxy and I create the melody.

SECONDS: *When you produce music, do you use it for your own therapeutic reasons? Do you use it for meditative purposes?*

TERENZI: I’m addicted to it. It talks to me. It puts you in a different state of mind. If you’re flying on an airplane while listening to it, it’s just beautiful. In the dark, it’s just great. It is very good to work to, when you are driving in traffic. Sometimes I turn on the TV and play the album because I like to listen while watching TV. In personal life, you start to watch what you’re doing from a different point of view that is much more universal. You realize that some of



Photo by Richard Kern

Dr. FIORELLA TARENZI

our everyday problems are not such big problems. When you're up there in space, you realize there are no frontiers. All Planet Earth is one nation, the same human race. From space you don't see any Black, any White, any Yellow. One unique kind, maybe the only kind. Planet Earth should be renamed Planet Life, because there's life in everything. It's amazing how much life we generate.

SECONDS: *Maybe it's our job to seed the whole universe.*

TERENZI: Exactly for that reason I want human space exploration to bring out what we have. Let's create a new human kind. Genetically speaking, the human race might not survive.

SECONDS: *Without life, everything would come to zero, right?*

TERENZI: Zero. It's the concept of yin and yang.

SECONDS: *Have you applied to go on the Space Shuttle?*

TERENZI: I did when I was in San Diego. I applied as a mission specialist. I did the questionnaire, took the test for eyes, and then there was a question that said, "Are you a US citizen?" So I wrote no and that was the reason they dropped me out. They said, "You are an Italian citizen — you need to apply through ESA, European Space Agency." I didn't even try to apply through ESA.

SECONDS: *Why?*

TERENZI: Because it's very complicated and because Italy's bureaucratic system is impossible.

SECONDS: *Anyway — since galactic radio signals occur at billions of hertz, could you tell us how you scale them down to frequencies that we can work with?*

TERENZI: We can hear sounds between 20 and 20,000 hertz. These radio waves are billions of hertz. Put into words, the process is simple. But when you load it down to the computer, it's not so simple anymore. It comes down to frequency reduction from billions of hertz into the human hearing range.

SECONDS: *At what point are the signals converted to an audible range?*

TERENZI: It's converted in the computer. If you want to listen, you have to use a sound synthesis computer language. It's my modification of cmusic.

SECONDS: *Once you've processed signals,*

how do you make the music.

TERENZI: I use the galaxy sound loaded into several samplers and I compose with it.

SECONDS: *You compose using a palette of sounds from the universe, as opposed to palette of Earthly noises.*

TERENZI: Exactly.

SECONDS: *How do the dynamics of the sounds differ?*

TERENZI: With the galaxy, you can sample so many different parts and each sample tells you something different. It's a galactic orchestra.

SECONDS: *What effect should your music to have on the listener?*

TERENZI: I want people to use it. I really fought to release such an avant-garde experimental album. The galaxy is yours so you can do whatever you want. You want to dance to it? Great. You want to meditate? It's yours. Do you want to trip? It's your project.

SECONDS: *Have you done all those things to it?*

TERENZI: Yes, and many, many other things. I did an experiment with Timothy Leary called Galactic Multi-Brain, and the people were really in trances. We had probe lights flashing at high frequencies and I was talking about the macro-universe and Leary was talking about our mind — a micro-universe. At the end, all the universe was inside our minds. It was a beautiful experience. We did a song together called "Search For Life."

SECONDS: *So you're going to be a rock star.*

TERENZI: I think I'm going to be a galactic star, or maybe a galaxy.

SECONDS: *Or maybe a shooting star.*

TERENZI: Well, a shooting star goes away quickly. I want to be a big galaxy containing many different stars.

SECONDS: *What's your background in science and music?*

TERENZI: I have a doctorate in physics, so I'm a physicist with a specialization in astrophysics. In music I don't have any degree. I studied for three years at the conservatorio — at the Corsi Popolari. I studied opera, piano, composition and harmony.

SECONDS: *What's the best music for erotic behavior?*

TERENZI: The best erotic music is the natural music. Since human beings are part of this natural environment, it might be the

“Genetically speaking, the human race might not survive.”

sounds of a river or the ocean or the galaxies!

SECONDS: *What would be the worst reaction a critic or listener could have to your music?*

TERENZI: Due to my analytical preparation, it's difficult for me to distinguish good reactions from bad reactions. I think if someone said it was boring, I would say to listen to it once more and open your mind. I don't take it personally because with science you have good and bad things all the time.

SECONDS: *Do you get some hot letters?*

TERENZI: They're hot. It's important to let the imagination go.

I read them and sometimes I say, “Oh my God, what's that!?”

SECONDS: *Are they telling you about something that happened during your music?*

TERENZI: Yes, they write what they were doing and what they felt. Maybe they'll tell me about their girlfriends or maybe they talk about some fantasy they

have while looking at my picture. They ask many, many questions.

SECONDS: *You're gorgeous. Are you the best looking astrophysicist?*

TERENZI: Oh, I don't know.

SECONDS: *Are you willing to exploit this sexual attractiveness to help the music?*

TERENZI: Sincerely, it doesn't matter what I wear. Actually, even if I wear a t-shirt and jeans, due to the shape I have, it all comes out — it gets worse.

SECONDS: *Or better.*

TERENZI: But I'm not going to use it like Madonna.



SECONDS: *Are you interested in psychedelia?*

TERENZI: I think so. I'm interested because it's a mind experiment. I like it because you see things you never saw before. I like it because there are some medical and physical applications to it.

SECONDS: *Have you had a psychedelic experience with a drug?*

TERENZI: No. I don't need a chemical to be out there. Sometimes people drag me down, but otherwise I keep on flying, going exploring new galaxies.

SECONDS: *What's going to be the next discovery in astrophysics?*

TERENZI: I believe it comes down to the Big Bang theory.

SECONDS: *So you think the next big discovery will be a confirmation of the Big Bang?*

TERENZI: Or some middle step — a higher knowledge about the Big Bang phenomenon. More data.

SECONDS: *What are your favorite planets?*

TERENZI: Saturn and Neptune.

SECONDS: *Far out. In conclusion, what Kepler described as music of the spheres is not where your music is coming from. His music was based on vibrations produced by the friction of planets moving through an ether-like medium. Yours is based on electromagnetism.*

TERENZI: It's not like the music of the spheres, but instead we saw the music of the universe. We saw harmony relating to each object — and harmony relating to human beings. ●●●