OBITUARY: Marina Gigolashvili (1943-12-08 – 2014-10-22) Member of Editorial Board of Sun and Geosphere

Germaine Cornelissen[1], Ketevan Janashia[2], Norma B Crosby[3], Elchin Babayev[4], Atila Ozguc[5]

[1]Halberg Chronobiology Center, University of Minnesota, Minneapolis, MN, USA
[2]Helio-magneto-cardiological Scientific and Practical Center, Tbilisi, Georgia
[3]Belgian Institute for Space Aeronomy, Brussels, Belgium
[4]Shamakhy Astrophysical Observatory, Azerbaijan National Academy of Sciences, Baku, Azerbaijan
[5]Bogazici University, Kandilli Observatory, Istanbul, Turkey

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The untimely death of Dr. Marina Gigolashivili is a great loss to the scientific community. Marina earned a PhD in astronomy from Tbilisi State University in 1965. Since 2007, she was a Professor and Project Leader at the E.K. Kharadze Abastumani Astrophysical Observatory at Ilia State University in Tbilisi, Republic of Georgia, after serving as Head of Solar, Planetary and High Atmosphere of the Earth at the Georgian Evgeni Kharadze National Observatory from 2004 to 2006, and as Scientific Leader at the Abastumani Astrophysical Observatory, Georgia from 1998 to 2004. Marina had many interests, notably in the fields of astronomy, astrophysics and solar physics. Her work dealt with the near-Earth cosmic space, solar-terrestrial connections, and environmental monitoring. In this context, she became involved in studies of chronobiology and chronomics. Indeed, while biological rhythms are now widely recognized to be partly endogenous, there is mounting evidence for important influences of space weather on biota, reflected in shared periodicities between physics and biology.

Marina had numerous publications, as evidenced from her partial bibliography reported below [1-59]. In cooperation with the Halberg Chronobiology Center [1-7], Marina Gigolashvili contributed to the investigation of two non-photic periodicities detected in the natural physical environment and in human physiopathology, namely the “transyear” with a period longer than precisely 1 year, usually of about 1.3 years which had been found in solar wind speed [60], and the “cis-half-year” with a period shorter than 6 months, usually of about 0.42 year resembling a component characterizing solar flares [61]. Both components were detected in records of supraventricular extrasystoles, supraventricular paroxysmal tachycardia, ventricular single extrasystoles, ventricular multiple extrasystoles, paroxysmal ventricular tachycardia and paroxysms of atrial fibrillation, and total cardiac arrhythmia for the span from April 1983 to 1992 in the Republic of Georgia [1-3]. As seen from Table 1, in one solar cycle stage (1983-1984), a circannual (seasonal) component is detected: the 95% confidence intervals (CI) of its nonlinearly estimated period overlaps 1.0 year. By contrast, during another solar cycle stage (1989-1990), a transyear and a cis-half-year are detected.

Table 1 Data from Tbilisi (Georgia) from Dr Levan Tvildiani. P: P-value from zero-amplitude (no-rhythm) test; A: Amplitude (in number of cases per day); φ: Acrophase, in (negative) degrees, with 360°□period length; 00= 1 Jan 1983. S: supraventricular extrasystoles; Ps: supraventricular paroxysmal tachycardia; V1: ventricular single extrasystoles; Vm: ventricular multiple extrasystoles; Pv: paroxysmal ventricular tachycardia; Pp: paroxysm of arterial fibrillation.

Arrhythmia	---	Period=1y	---	TY (trial period = 1y)						CisHalfYear (Trial period = 0.42y)					
	P	A	φ	Period	(95%	CI)	A	(95%	CI)	Period	(95%	CI)	A	(95%	CI)
							1983-1984								
S	**0.034**	0.058	-234	0.932	0.647	1.216	0.06	-0.00	0.13	**0.431**	**0.400**	**0.462**	**0.11**	**0.04**	**0.18**
Ps	***0.079***	0.042	-228	0.974	0.605	1.343	0.04	-0.02	0.10	**0.439**	**0.413**	**0.464**	**0.12**	**0.06**	**0.17**
V1	**0.002**	0.087	-207	**1.024**	**0.760**	**1.288**	**0.09**	**0.01**	**0.16**	**0.432**	**0.401**	**0.463**	**0.12**	**0.05**	**0.20**
Vm	**0.034**	0.056	-214	1.000	0.647	1.353	0.06	-0.01	0.12	**0.438**	**0.408**	**0.467**	**0.11**	**0.05**	**0.18**
Pv	0.255	0.008	-70	1.000	0.484	1.516	0.00	-0.00	0.02	---	---	---	---	---	---
Pp	0.151	0.009	-230	1.000	0.546	1.454	0.00	-0.00	0.02	---	---	---	---	---	---
							1989-1990								
S	0.386	0.024	-11	---	---	---	---	---	---	***0.528***	***0.456***	***0.599***	***0.06***	***0.00***	***0.11***
Ps	**<0.001**	0.069	-64	**1.347**	**1.042**	**1.652**	**0.09**	**0.03**	**0.14**	---	---	---	---	---	---
V1	**0.001**	0.103	-66	**1.439**	**1.044**	**1.834**	**0.13**	**0.04**	**0.22**	---	---	---	---	---	---
Vm	0.162	0.036	-67	***1.690***	***0.979***	***2.400***	***0.10***	***0.04***	***0.15***	---	---	---	---	---	---
Pv	0.826	0.003	-5	---	---	---	---	---	---	***0.361***	***0.331***	***0.390***	***0.02***	***0.00***	***0.04***
Pp	***0.095***	0.016	-4	***1.289***	***0.879***	***1.700***	***0.02***	***0.00***	***0.05***	---	---	---	---	---	---

Similar components were found to characterize the incidence of sudden cardiac death in some geographic locations but not in others [4], Table 2. A transyear with a period of about 1.3 years was also detected in the longitudinal record of an elderly man's systolic blood pressure measured around the clock by ambulatory monitoring, changes in its period length and relative prominence following the time course of this component assessed in solar wind speed [5].

Table 2 Geomagnetic/Geographic Differences among Cycles with Periods in the Range of 0.8 – 2.0 years* Characterizing the Incidence of Sudden Cardiac Death[1]

Site	Span	T, Δt, N	SCD (N)	Period (y)	(95%CI)	Amplitude	(95%CI)	A(% MESOR)	P-value[2]
				Transyear (TY) or Candidate Transyear (cTY) Detected					
Minnesota	1999-2003	5y, 1d, 1826	343	1.392 (TY)	(1.173, 1.611)	0.042	(0.00, 0.09)	22.0	0.014
Arkansas	1999-2003	5y, 1d, 1826	273	1.095	(0.939, 1.251)	0.032	(0.00, 0.07)	21.1	0.040
				1.686 (cTY)	(1.293, 2.071)	0.031	(0.00, 0.07)	20.7	0.044
Czech Rep.	1999-2003	5y, 1d, 1826	1006	0.974	(0.856, 1.091)	0.078	(0.00, 0.16)	14.2	0.007
				1.759 (cTY)	(1.408, 2.110)	0.077	(0.00, 0.15)	13.9	0.010
	1994-2003	10y, 1d, 3652	1792	1.726 (TY)	(1.605, 1.848)	0.074	(0.02, 0.13)	15.1	<0.001
				1.000	(0.944, 1.056)	0.052	(0.00, 0.10)	10.6	0.010
				Candidate Transyear Not Detected					
North Carolina	1999-2003	5y, 1d, 1826	752	0.929	(0.834, 1.023)	0.069	(0.00, 0.14)	16.9	0.007
Tbilisi, Georgia	Nov'99-2003	4.1y, 1d, 1505	130	0.988	(0.862, 1.114)	0.035	(0.00, 0.07)	40.7	0.007
Hong Kong	2001-2003	3y, 1m, 36	52	0.843	(0.651, 1.036)	0.022	(NS)	44.9	0.077

* with focus on transyears (with periods of about 1.3 years).
[1] International Classification of Diseases (ICD10) Code I46.1 excluding myocardial infarctions and sudden death of unknown or unspecified cause (except before1999).
T: length of data series (y=years); □t: sampling interval (d=day, m=month); N: number of data.
Period and 95% confidence interval (CI) estimated by nonlinear least squares.
[2] From linear least squares analysis, not corrected for multiple testing.
Amplitude expressed in N/day.

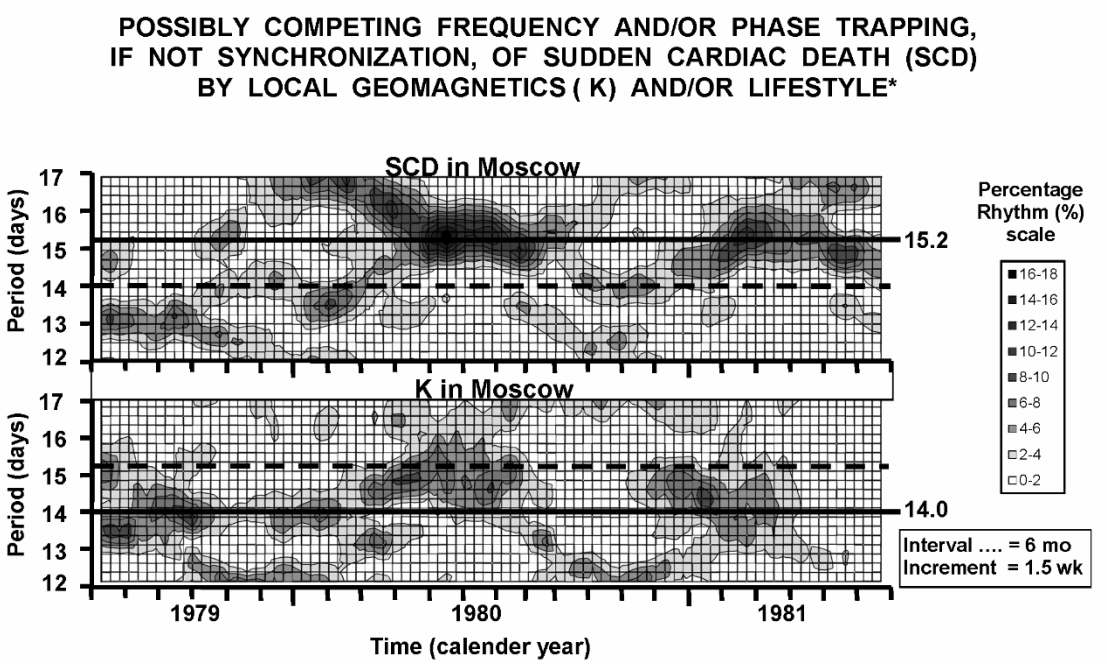

Figure 1. Wobbliness of the about 2-week variation in sudden deaths (top) and the local index of geomagnetic activity (bottom), revealed by gliding spectra wherein data in a 6-month interval are progressively displaced by a 1.5-week interval. Note that detection of the about 2-week component is not consistent throughout the 3-year span. A possible resonance with occasional frequency trapping between the about 2-week component of K and sudden death is suggested by the more prominently expressed about half-monthly variation in sudden deaths observed when this component is also detected in the spectrum of K. © Halberg Chronobiology Center.

As a signature of solar activity, a cis-half-year with a period of about 0.42 year was also found in the incidence pattern of sudden cardiac death in Minnesota, USA, among other geographic locations, and in circulating melatonin determined around the clock in 172 subjects studied between October 1992 and December 1995 in Florence, Italy [7]. Melatonin may mediate some of the Sun's effects upon the biosphere in certain frequency-windows such as a cis-half-year of about 5 months.

Similarities between the behavior in time of sudden cardiac death incidence and the non-photic environment were also shown with Marina in data from Moscow, Russia collected between 1979 and 1981 [6]. An about half-monthly component was detected with a period of 15.2 days. Its 95% confidence interval (CI) extended from 15.15 to 15.30 days. By the criterion of a non-overlap of CIs, this period was statistically significantly different from the half-monthly period characterizing the local index of geomagnetic disturbance K analyzed during the same 3-year span, estimated to be 14.0 days (CI: 13.94 - 14.17 days). Whereas the about half-monthly period of both variables was estimated with a relatively small uncertainty when analyzed over the entire 3-year span, this component's period showed great wobbliness when the data were analyzed by moving spectra over a shorter interval of 3 months, progressively displaced by 1.5 weeks throughout the time series. This component was not consistently detected, neither for the daily incidence of sudden cardiac death, nor for the local K index. A possible resonance with occasional frequency trapping between the multiseptans of the two variables was observed, the half-monthly component being more prominently expressed in the incidence of sudden cardiac death when it was also detected in the spectrum of the geomagnetic index K [6], Figure 1.

Among others, a transyear with a period of 1.65 [CI: 1.43, 1.86] years and a cis-half-year with a period of 0.388 [CI: 0.377, 0.398] year were also detected in the daily incidence of sudden cardiac death (SCD WHO code ICD-10, classification I46.1) in the Absheron Peninsula, including the capital city Baku (Azerbaijan, over 3 million inhabitants), obtained from 21 emergency and first medical aid call stations and a central station between 15 November 2002 and 30 June 2009 [62].

Dr. Gigolashvili was active in several societies, including the International Academy of Science Health and Ecology, the Georgian National Presentation of the International Space Weather Initiative, Georgian National Representative and one of the founders of the Balkan, Black Sea and Caspian Sea Regional Network on Space Weather Studies and the Georgian National Presentation of the Joint Organization for Solar Observations. She was on the Editorial Board of the Journal of Applied Biomedicine, the Transactions of the International Academy of Sciences (Science without Borders), and the International Journal Sun and Geosphere. She was a member of the Georgian National Presentation of the International Heliophysical Year from 2005 to 2009. For her contributions in chronobiology and chronomics, she became a member of the Project on the BIOsphere and the COSmos (BIOCOS) coordinated by the Halberg Chronobiology Center at the University of Minnesota. She was a member of the Dissertation Council on conferring upon Ph.D. degrees on astronomy in the Shamakhy Astrophysical Observatory (ShAO), Azerbaijan National Academy of Sciences. She also contributed in preparation of several Ph.Ds. as well as in organization of scientific conferences in ShAO.

At the time of her passing, the Helio-magneto-cardiological Scientific and Practical Center (Tbilisi, Georgia), the Georgian Technical University, and the E.K. Kharadze Abastumani Astrophysical Observatory had gained support from the International Science and Technology Center (ISTC) for a project titled "Elaboration of a universal test on magneto-sensitivity". The project aims at designing a clinical-technical test for the detection of magneto-sensitivity in humans, using the individual responses to geomagnetic disturbances as evaluation criteria. Dr. Marina Gigolashvili served as the principal investigator for work at the E.K. Kharadze Abastumani Astrophysical Observatory, which predicts geomagnetic storms at local (Georgian) latitudes. Marina's hope was that early diagnostics and the forecasting of probable deviations in the activity of the autonomic nervous system during geomagnetic storms may thus be gained. Her proposal, now managed by Professor Ketevan Janashia, in cooperation with Dr. Norma B. Crosby, should have important scientific, medical and economic value regarding the safety and protection of workers engaged in high psycho-emotional intensity tasks, such as pilots and astronauts, as well as of patients with cardio-vascular diseases.

With medical applications to her work as a physicist, Marina followed a truly transdisciplinary approach. BIOCOS will miss an invaluable member as will her family and friends and colleagues.

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