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Timing noise of radio pulsars and implications to neutron star's interior structure and gravitational wave detection

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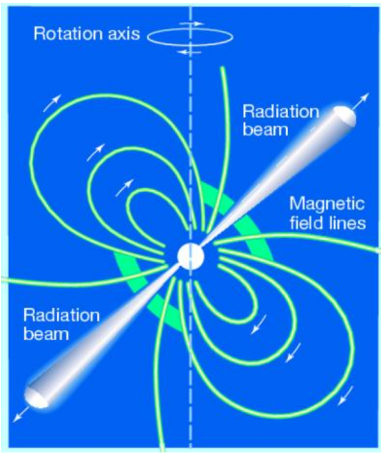
Prof. Zhang is the Director of Key Laboratory of Particle Astrophysics and Center for Particle Astrophysics at IHEP, and a Chief Scientist of Space Science Division and Director of the X-ray Imaging Laboratory at NAOC, and a Research Full Professor (on-leave) at Physics Department, University of Alabama in Huntsville. He obtained his bachelor degree from Tsinghua University in 1984. He did his graduate research at Southampton University in UK on gamma-ray astronomy and received his PhD degree in 1989. He then spent three years as a postdoctoral research fellow at University of Pennsylvania. He joined the BATSE/CGRO team in 1992 and developed the earth occultation imaging technique. In 1998 he moved to University of Alabama at Huntsville as a tenure track assistant professor. In 2002 he moved back to China, as a distinguished professor of physics in Tsinghua University. Since 2009, he has become the director of the Center for and the Key Laboratory of Particle Astrophysics in Institute of High Energy Physics, CAS. Since 2010, he has become an adjunct faculty and the chief scientist of the Space Science Research Division and director of the X-ray Imaging Laboratory at NAOC. His research interests cover most areas in high energy astrophysics (e.g., radio pulsars, neutron star X-ray binaries, black hole X-ray binaries, microquasars, gamma-ray bursts, active galactic nuclei), as well as interstellar medium, star forming galaxies, cosmology, general relativity, space instrumentation, etc. He is also leading or playing major roles in several space high energy astrophysical missions of China. He has authored and co-authored more than 200 refereed publications with about 5000 total citations.



Abstract

Radio pulsars are the most stable natural clocks in the universe, yet timing irregularities or noises can still be substantial when the times of arrivals of their pulses are fitted with some well accepted spin-down models or templates of pulsars. In this talk, I will review our recent work on modeling the timing noises of radio pulsars. Our model includes a long-term power-law decay modulated by periodic oscillations of the surface magnetic fields of neutron stars. Our model can explain both the statistical properties of their timing noises. We find that the spin-down evolutions of young and old pulsars are dominated by the power-law decay and periodic oscillations, respectively. By applying our model to the individual spin-down evolutions of several well-measured radio pulsars, we find evidence for Hall drifts and Hall waves in the crusts of neutron stars. The relaxation behaviors of both classical and slow glitches can also be modeled as evolution of their surface magnetic fields, but with opposite trends. Finally we also attempt to improve the sensitivity of detecting gravitational waves with pulsars by applying our model to reduce the timing residuals of millisecond radio pulsars. The main publications related to this talk can be found at this ads link:
http://adsabs.harvard.edu/cgi-bin/nph-abs_connect?library&libname=pulsar+timing&libid=44cf02882f

All are welcome! Tea, coffee, biscuits will be served at 2:15 P.M.