

# Are pulsars neutron or quark stars?

Renxin Xu<sup>1</sup>

<sup>1</sup>School of Physics, Peking University, Beijing 100871, China

**ABSTRACT:** As was said by Arthur Eddington that “not only is the Universe stranger than we imagine, it is stranger than we can imagine”, pulsar-like stars have really surprised astronomers since their discovery for  $\sim 40$  years. Pulsars were supposed to be associated with oscillation of white dwarfs when discovered, but soon identified as rotating “neutron” star composed dominantly of neutron matter. The standard model of particle physics develops in 1960s, and it is recognized that (i) neutrons are not point-like particles and (ii) the strong interaction between quarks, of which neutrons are composed, is asymptotically free (i.e., the interaction force is almost zero in high energy limit). Quark matter composed of free quarks is naturally expected accordingly. Does quark matter form and remain after supernova explosions? This is a real question not been answered with certainty yet!

Thanks to advanced facilities, members in the family of pulsar-like stars are discovered and distinguished by their different manifestations. Though one may conventionally think that they are neutron stars, but the quark star idea is still not ruled out. The author will summarize the achievements in his pulsar group, including quark matter phenomenology at low temperature, starquakes of solid pulsars, low-mass quark stars, and the pulsar magnetospheric activities, with a pedagogical overview of quark matter and quark stars, in the talk.