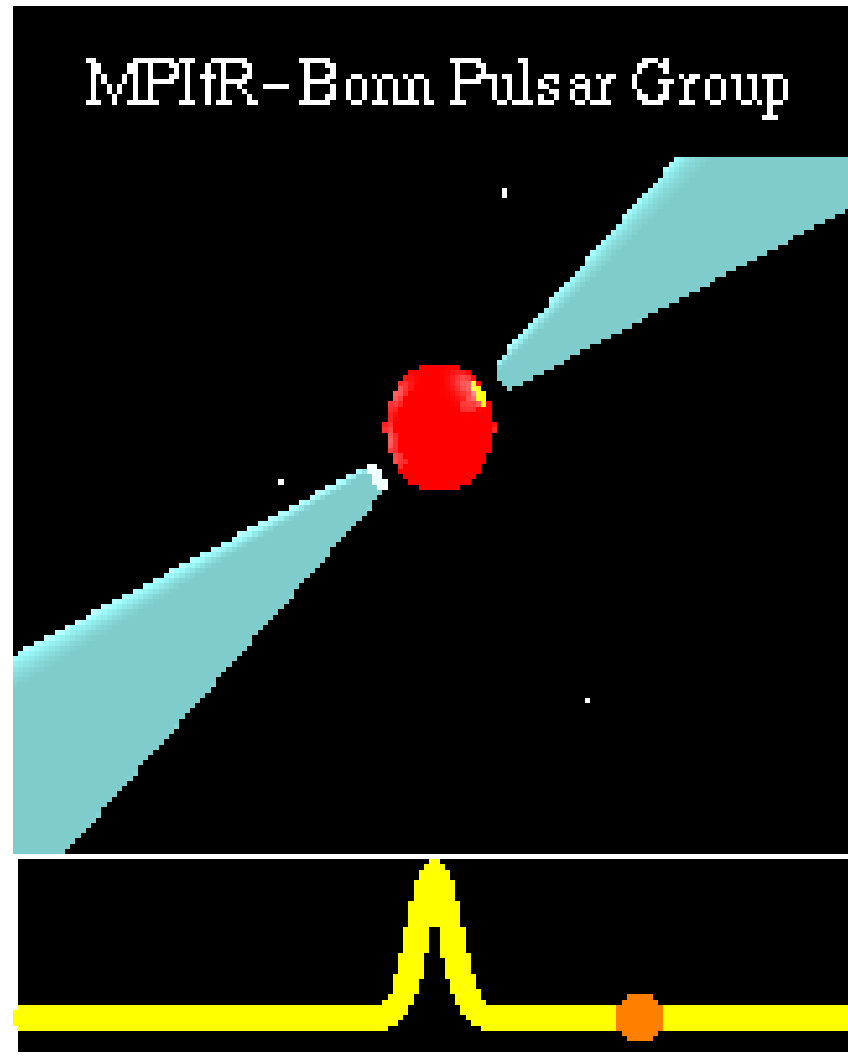# Two types of glitches in a solid quark star model

Jiguang Lu

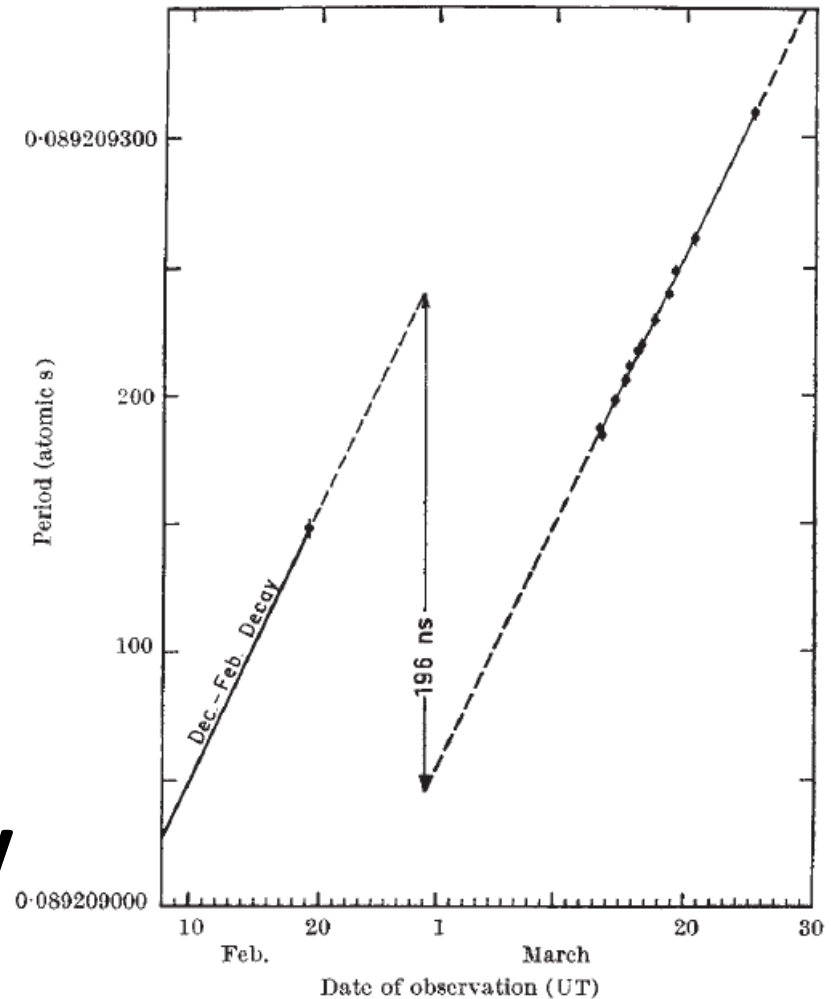Oct 22, 2014

E. P. Zhou, J. G. Lu, H. Tong and R. X. Xu, 2014, MNRAS
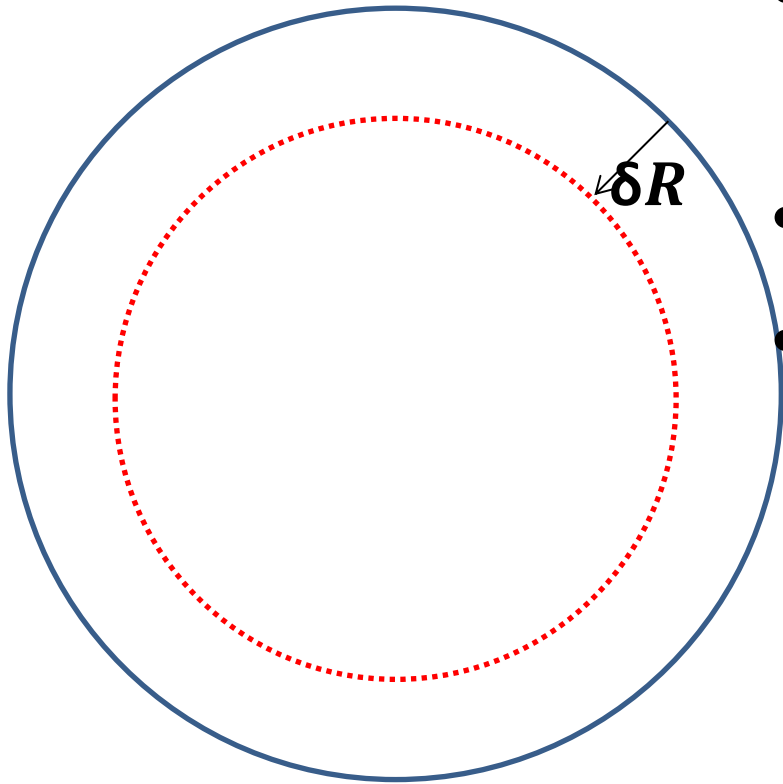
Pulsar

Glitch

- **Sudden spin-up**
- **AXP/SGR glitch: with detectable energy release;**
- **Glitch of pulsars like Vela: without observable energy release.**
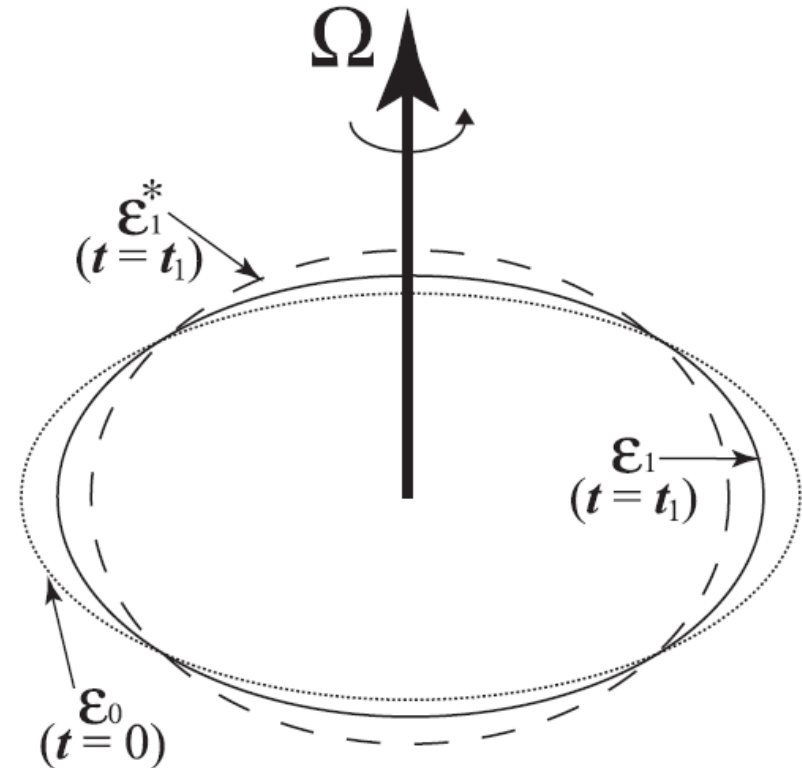

Radhakrishnan, V. & Manchester, R. N., 1969

Bulk variable starquake

δR

- ρ-R relation variation induced by accretion
- Elasticity of the solid star
- The collapse of the star lead to inertia moment decrease and spin-up.
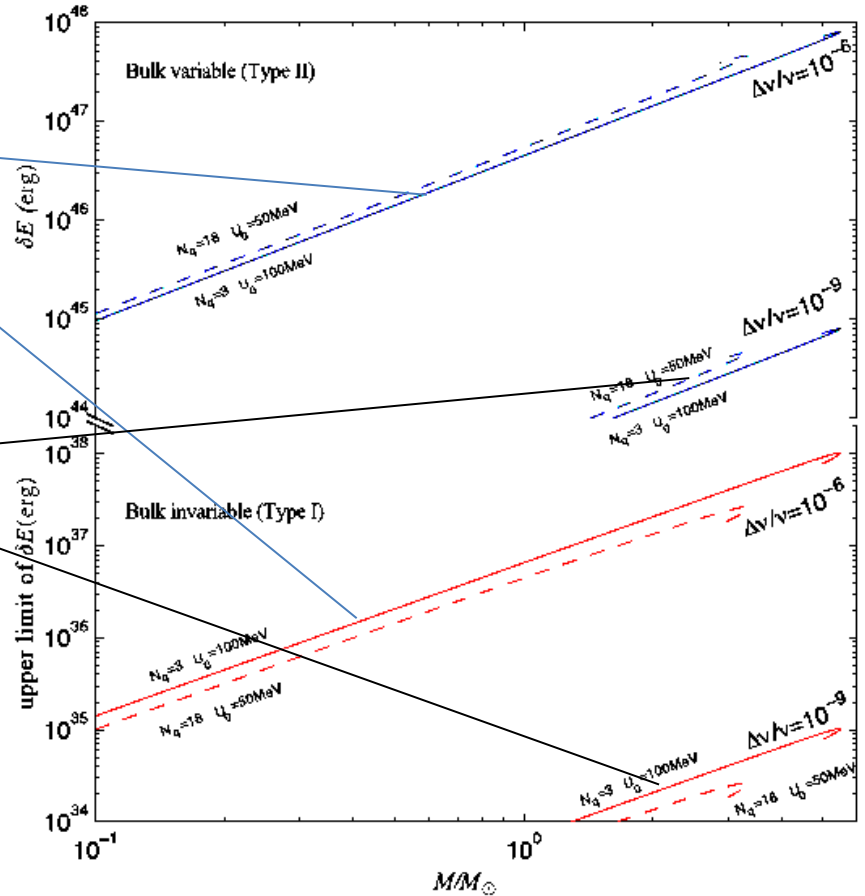
Bulk invariable starquake

- Spin-down induced by dipole radiation

- Elasticity of the solid star

- The collapse of the star lead to inertia moment decrease and spin-up.

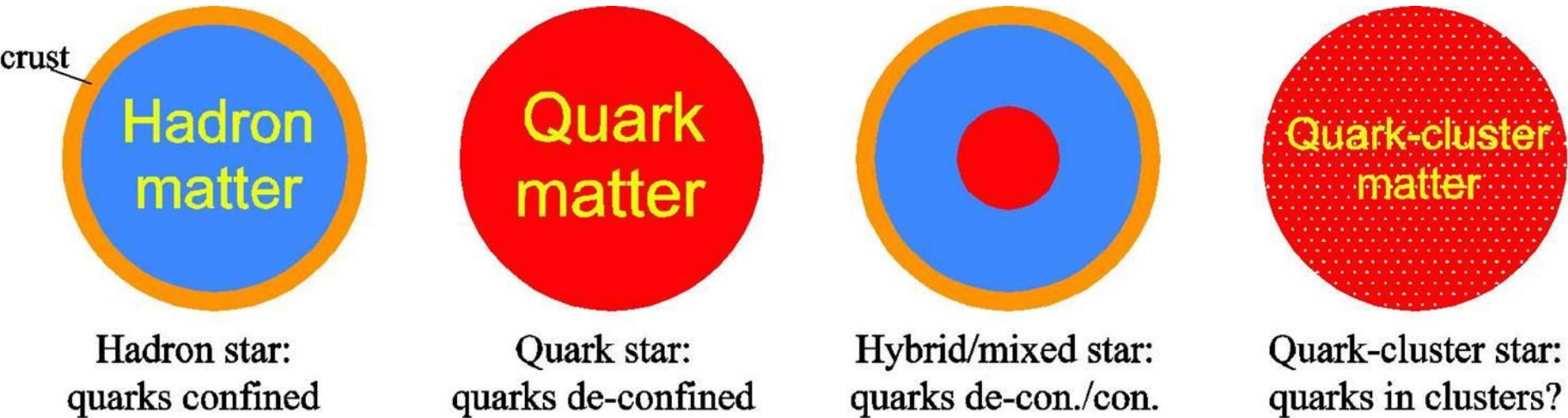# The result

$$\frac{\Delta \nu}{\nu} \sim 10^{-6}$$

$$\frac{\Delta \nu}{\nu} \sim 10^{-9}$$

AXP/SGR glitch ⇔ bulk variable starquake
Vela like pulsar glitch ⇔ bulk invariable starquake

Discussion and Summary

crust

Hadron matter

Quark matter

Quark-cluster matter

Hadron star: quarks confined

Quark star: quarks de-confined

Hybrid/mixed star: quarks de-con./con.

Quark-cluster star: quarks in clusters?

- Two types of glitch may be an implication that the pulsar is composed by quark matter or quark-cluster matter.

Thanks!

two types of glitches in a solid quark star model