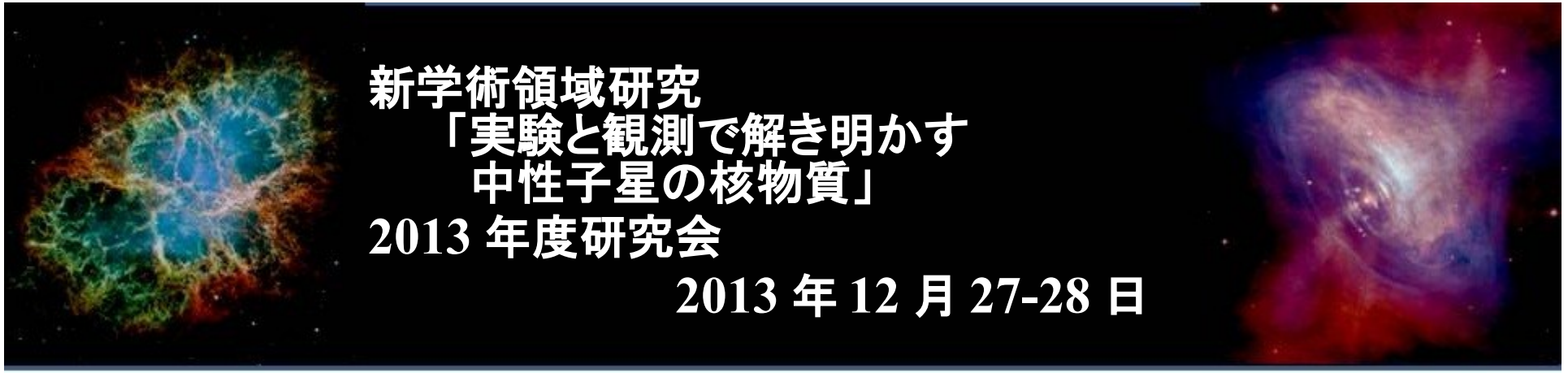
D01 班（理論班）研究報告

京大基研　大西　明



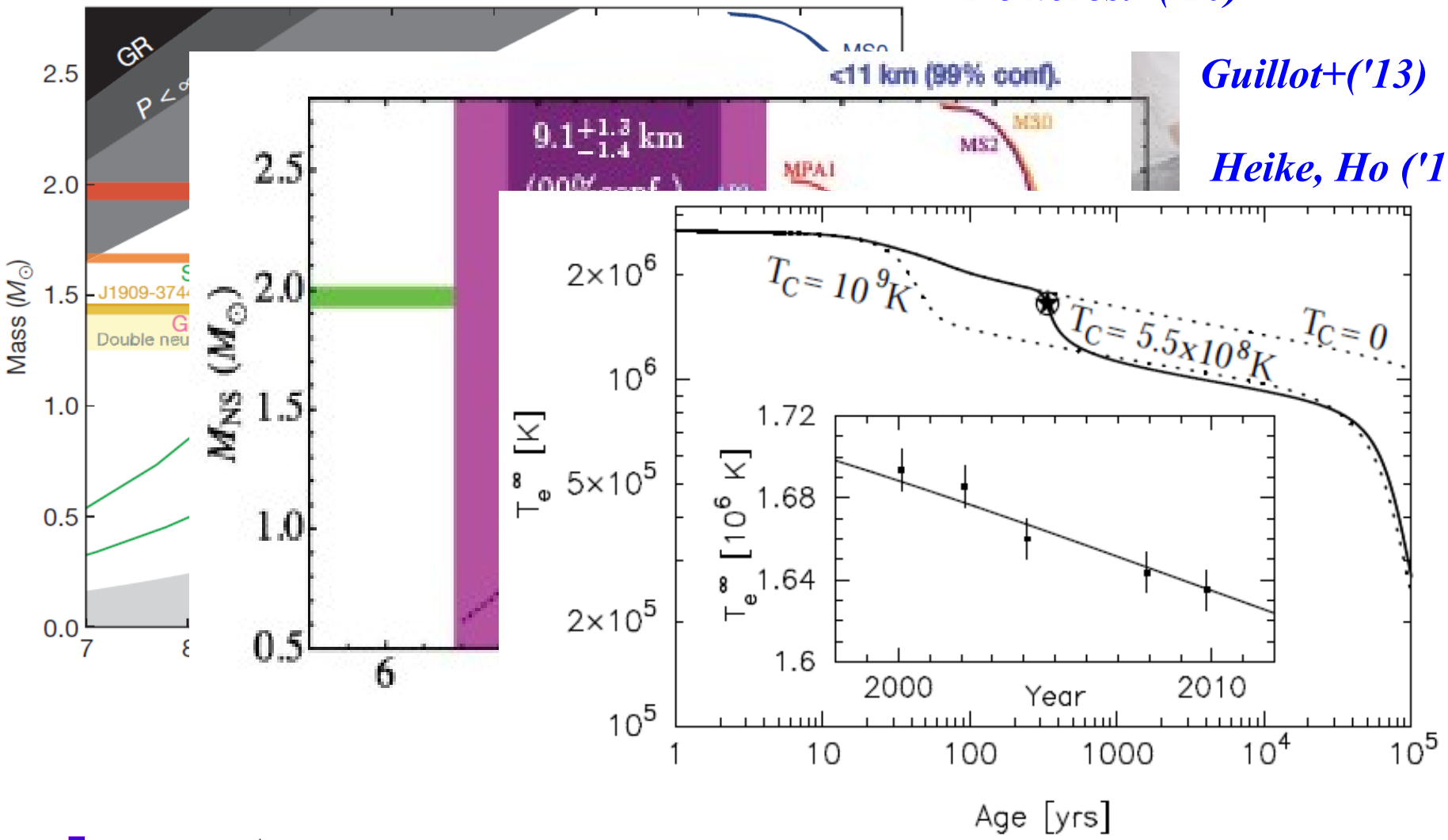
Three Current Big Puzzles of NS

- **Massive NS puzzle (2 Msun NS puzzle),**
  Compact NS puzzle (9 km NS puzzle),
  Rapid NS cooling puzzle (CasA puzzle)

Demorest+('10)

Guillot+('13)

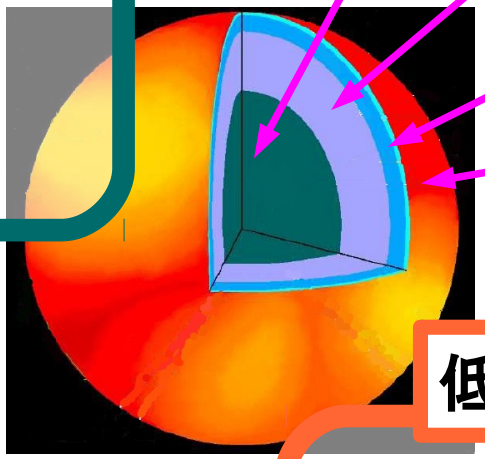
Heike, Ho ('10)



実験と観測で解き明かす中性子星の核物質

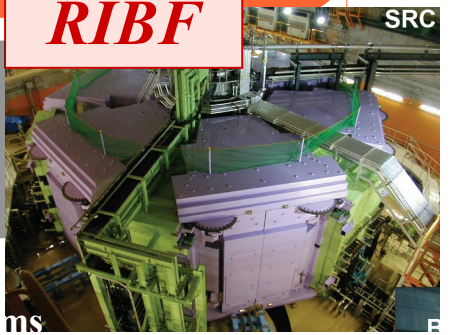
高密度領域 (A 班)

ハイパー核、K 中間子核、
YN, YY 相互作用、
有効相互作用、
(重イオン衝突) 、



低密度領域 (B 班)

対称エネルギー、
対相関ギャップ、
BEC-BEC cross over 、
冷却原子系とのつながり、



天体現象 (C 班)

半径、質量、
温度(時間依存性)、
星震、パスタ、

中性子星と核物質の理論研究 (D01: 理論計画班)

高密度領域

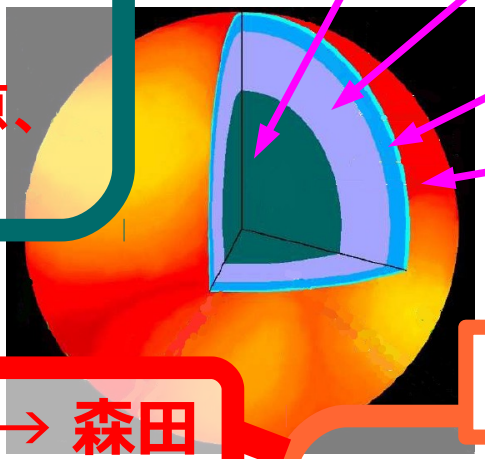
原田 (Prod.) 、
木村 (Structure) 、
土手 (Kaon Nucl.) 、
研究員 : 山縣 - 関原 → 椿原、
公募 : 根村

Hyperons, mesons, quarks

Asym. nuclear matter
+elec.+μ

Nuclei+neutron gas+elec.

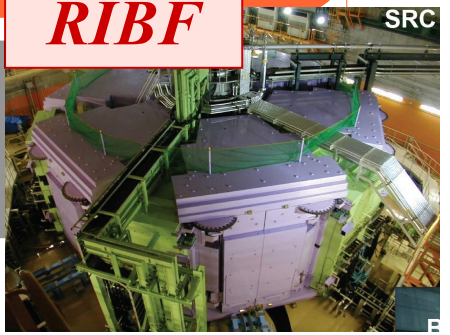
Nuclei + elec.



大西、祖谷 → 森田

低密度領域

中田 (Sym.E) 、
松尾 (EOS) 、
小野 (HIC) 、
研究員 : 稲倉 → 池野、
公募 : 萩野、大橋



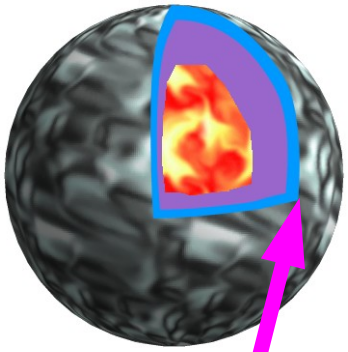
天体現象

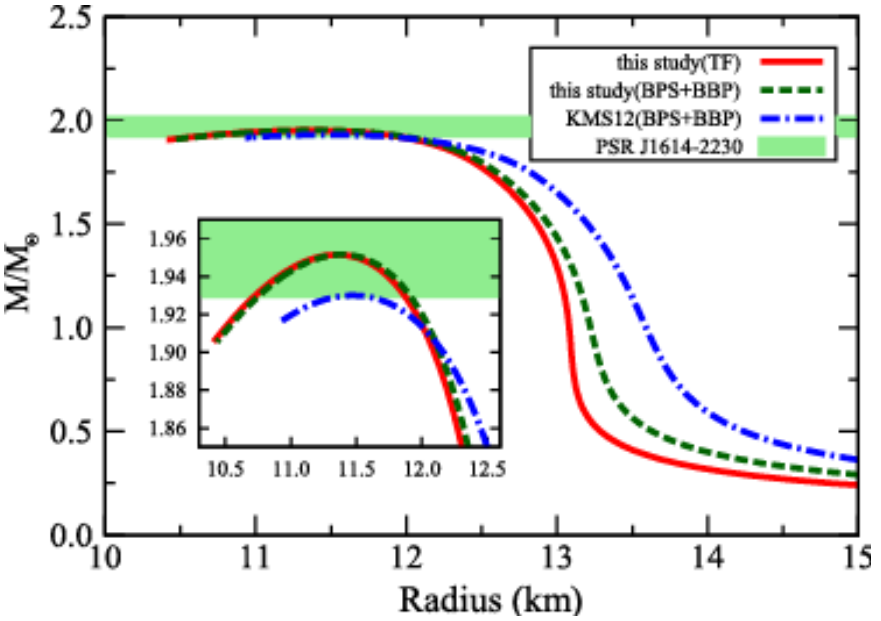
飯田 (Phen.) 、
巽 (Quark) 、
中里 (Pasta) 、
研究員 : 石塚 → 李、
公募 : 木内、安武

連携 : 国広、西崎、親松、丸山、阿武木、大橋、柴崎、中務 (B)
- 山本、高塚、河野、宮川、武藤、住吉、佐川

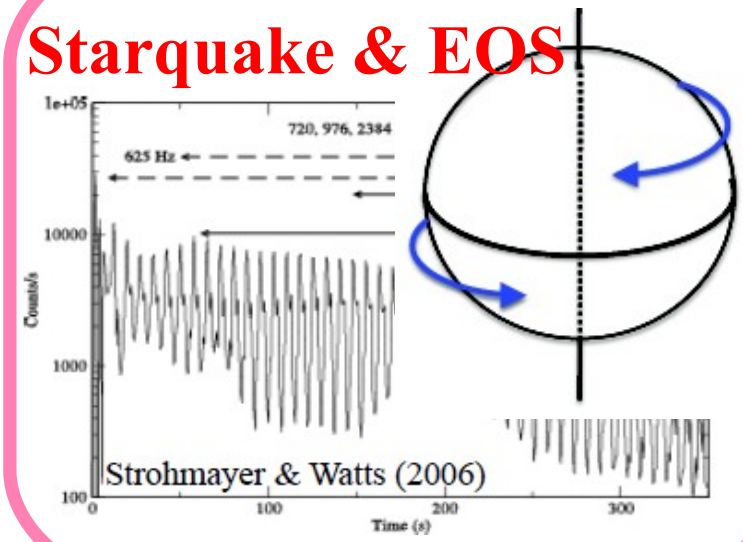
D01:Achievements

Purpose: NS matter EOS & Understanding Compact Star Phen.



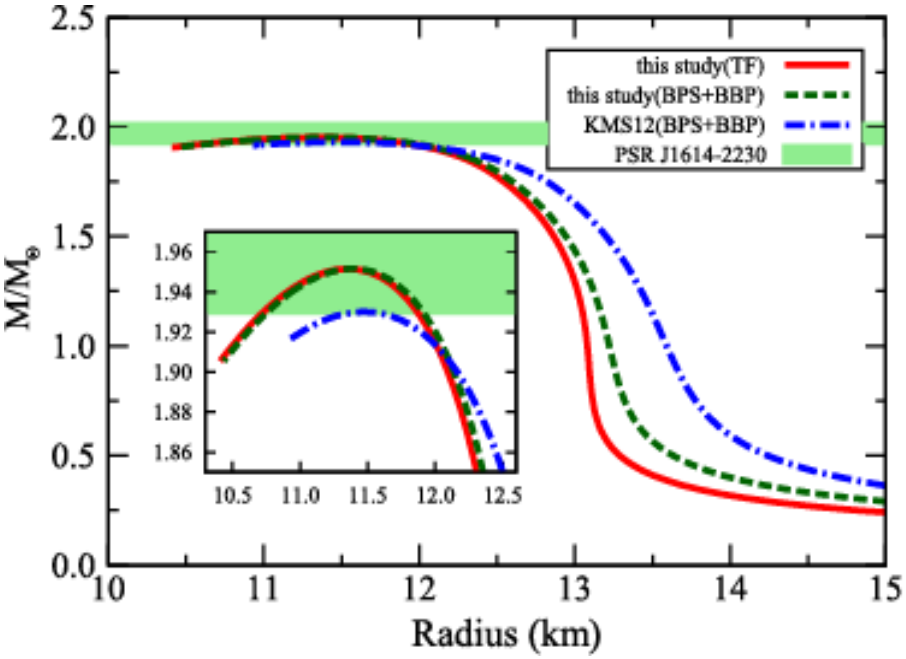


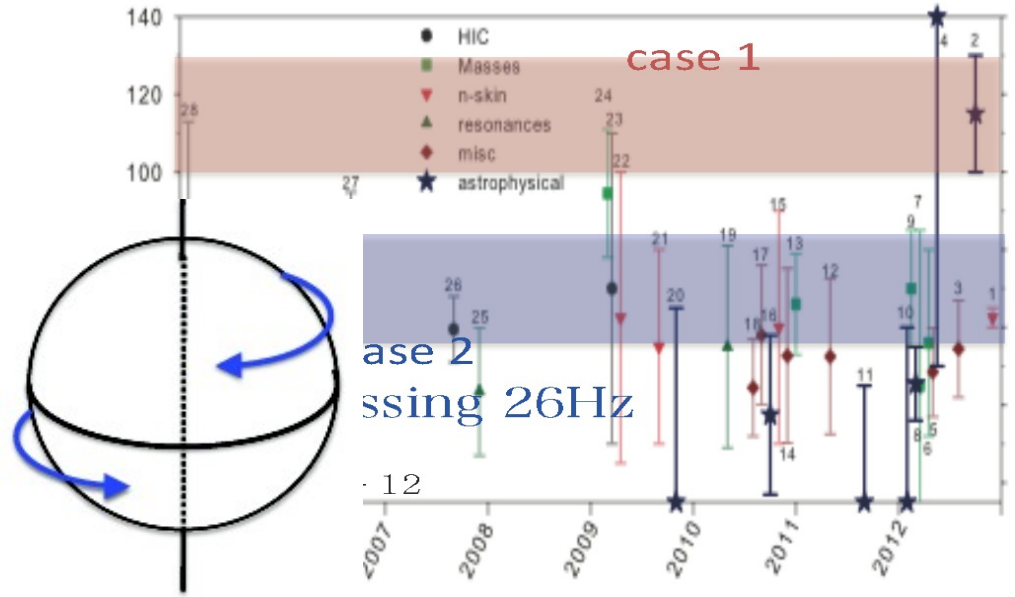
Starquake & EOS



High Light in D01:Astrophysics

- **Neutron Star Matter EOS**
  [T. Miyatsu, S. Yamamuro, K. Nakazato, ApJ 777 (2013), 4]
  - **Quark-Meson Coupling model predict stiffer hyperonic EOS at high density, which is consistent with 2 Msun NS.**
- **Neutron Star Quake and Sym. E**
  [*H. Sotani, K. Nakazato, K. Iida, K. Oyamatsu, MNRAS 434('13),2060]*
  - **Quasi-Periodic Oscillation during the giant flare of neutron stars would constrain Esym.**
- **Inhomogeneous condensate & Density**
  [*T. Noda, M. Hashimoto, N. Yasutake, T. Maruyama, T. Tatsumi, M. Fujimoto, ApJ 765 (2013), 1]*





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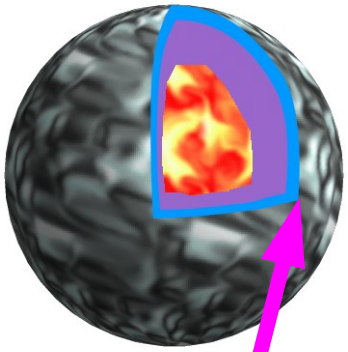

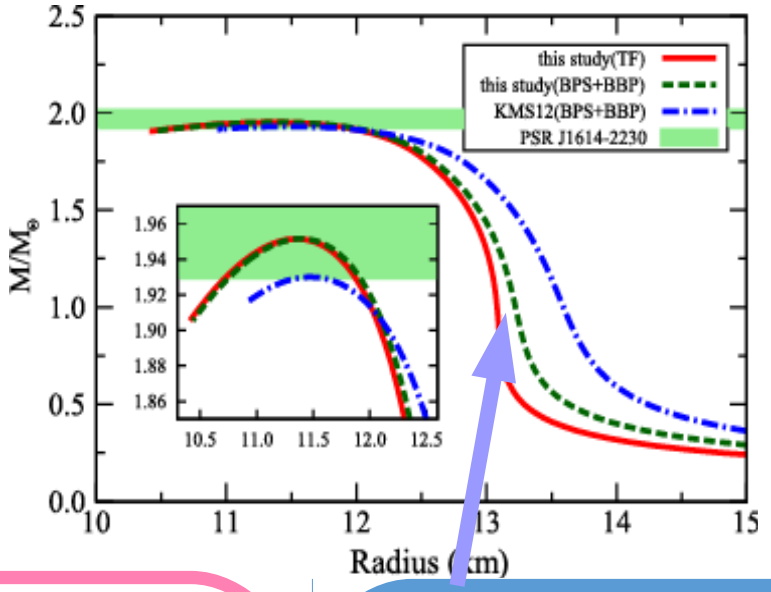

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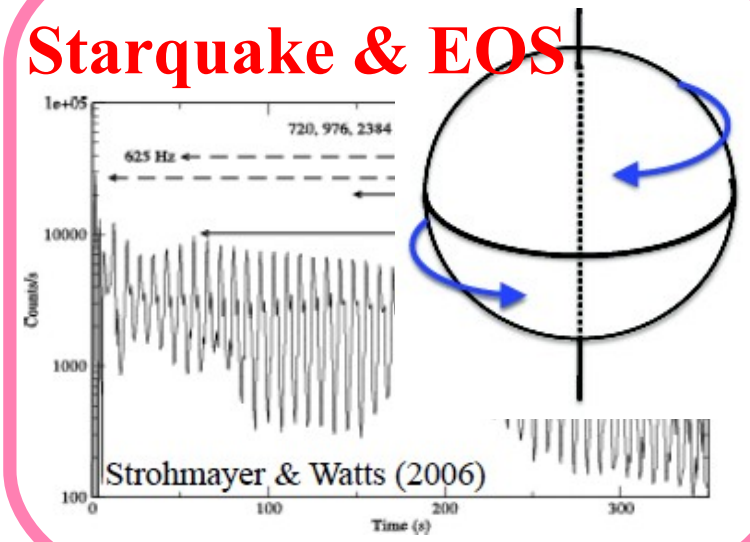
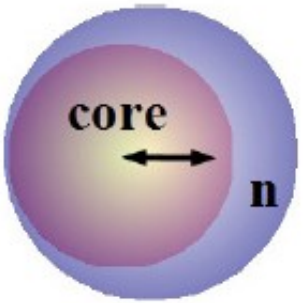
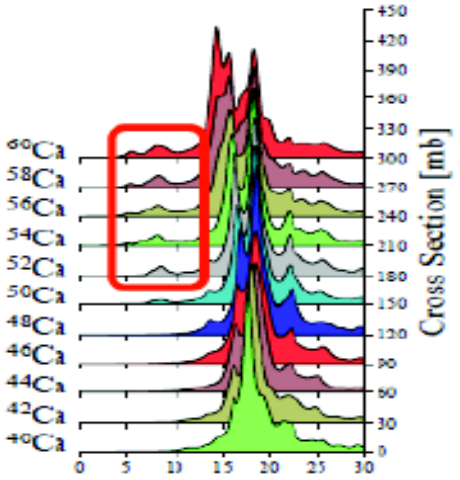


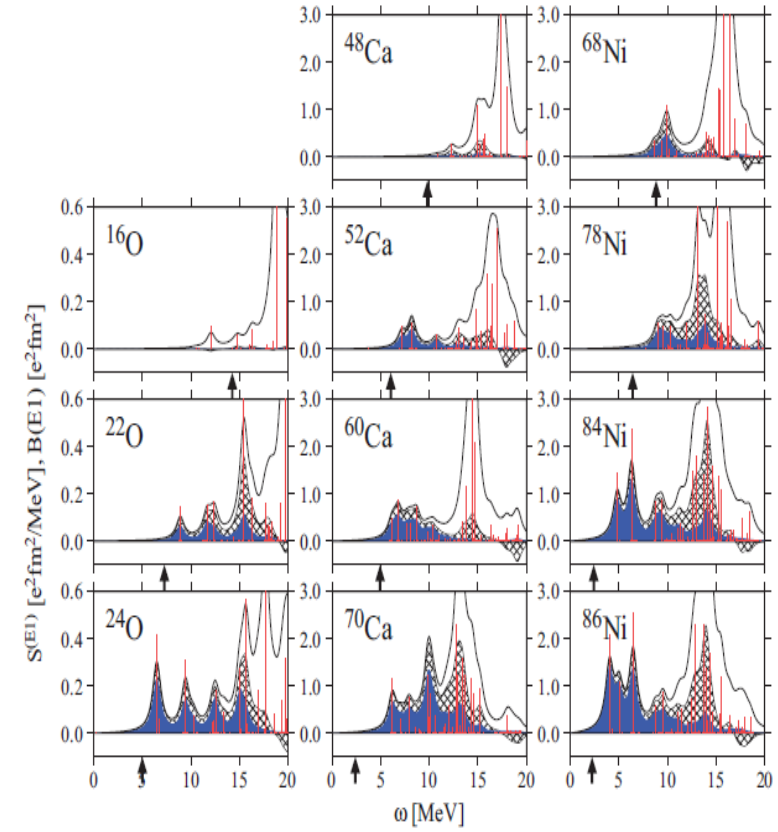
Pygmy Res & Sym. E

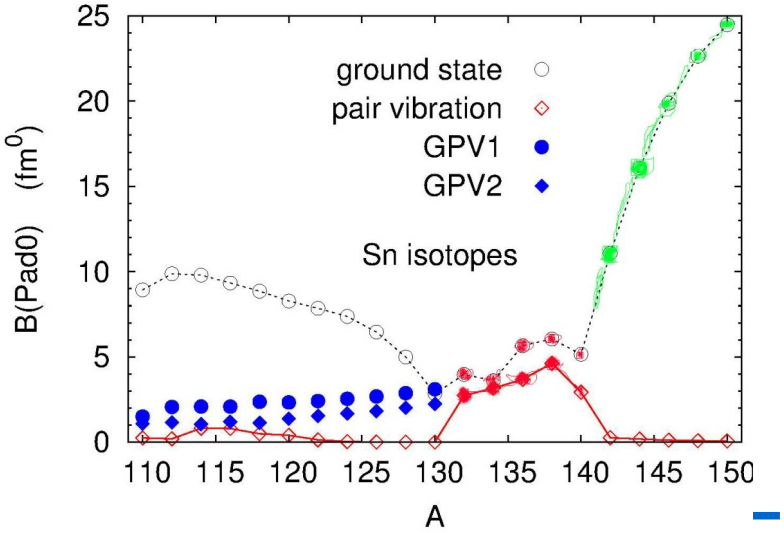




High Light in D01: Low Density NS matter

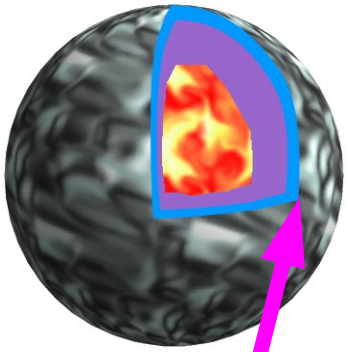
- **Pygmy resonance & Esym**
  [H. Nakada, T. Inakura, H. Sawai, Phys. Rev. C 87 (2013), 034302]
  - **Pygmy res. strength is predicted for various isotopes systematically. Strength sum is closely related to Esym.**
- **Pair Transfer**
  [H. Shimoyama, M. Matsuo, Phys. Rev. C88 (2013), 054308]
  - **In neutron rich nuclei, two neutron pair behaves like a boson, and extends around the surface. This BEC-like behavior may be confirmed via the two neutron transfer strength.**
- **Cluster correlation**
  [A. Ono, J. Phys. Conf. Ser. 420 (2013) 012103]
  → Ono's talk

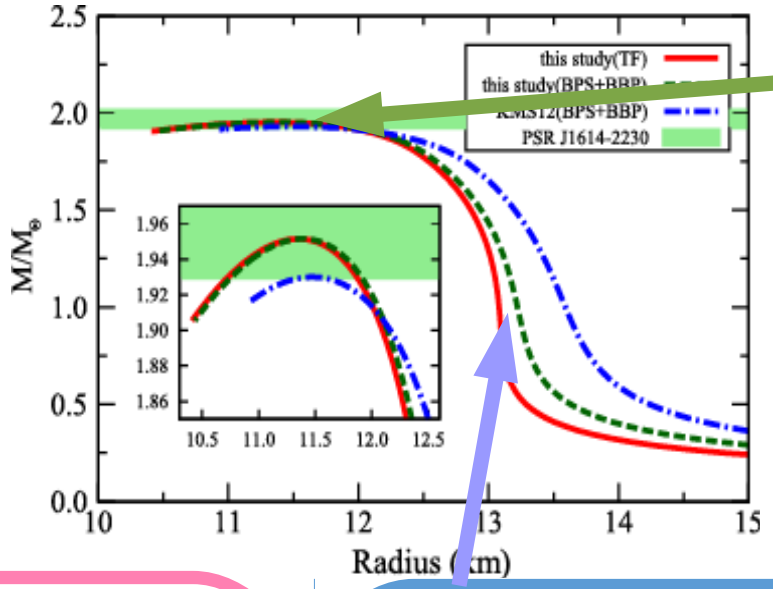




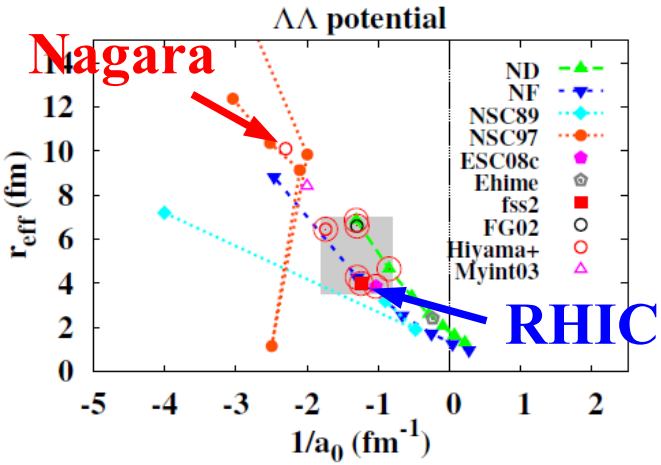
D01:Achievements

Purpose: NS matter EOS & Understanding Compact Star Phen.





BBB 3 body force



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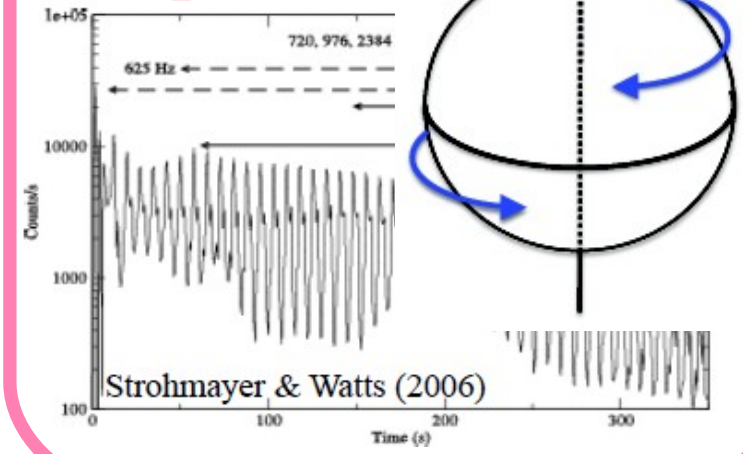
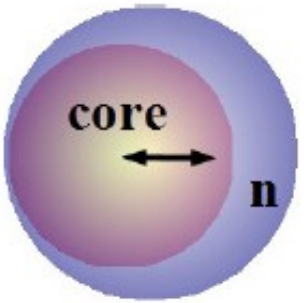
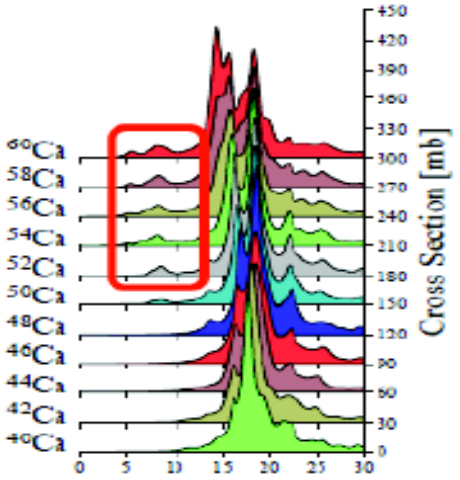
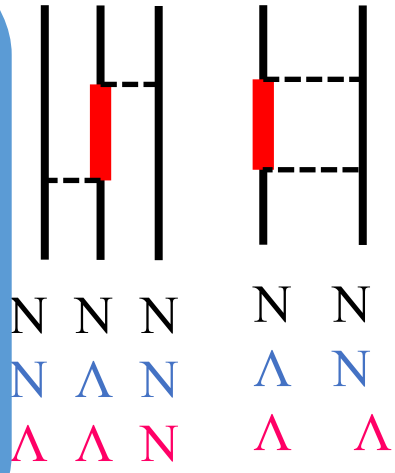


Pygmy Res & Sym. E

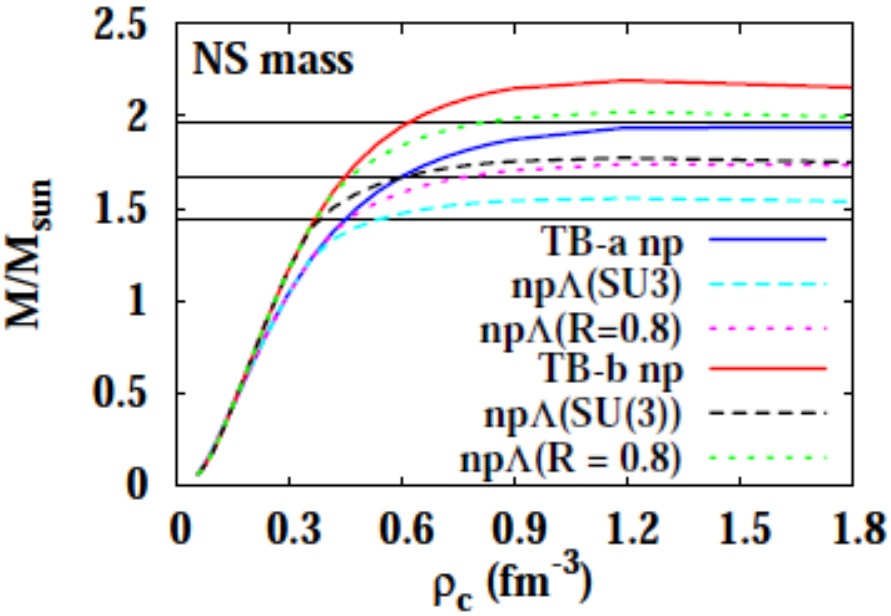


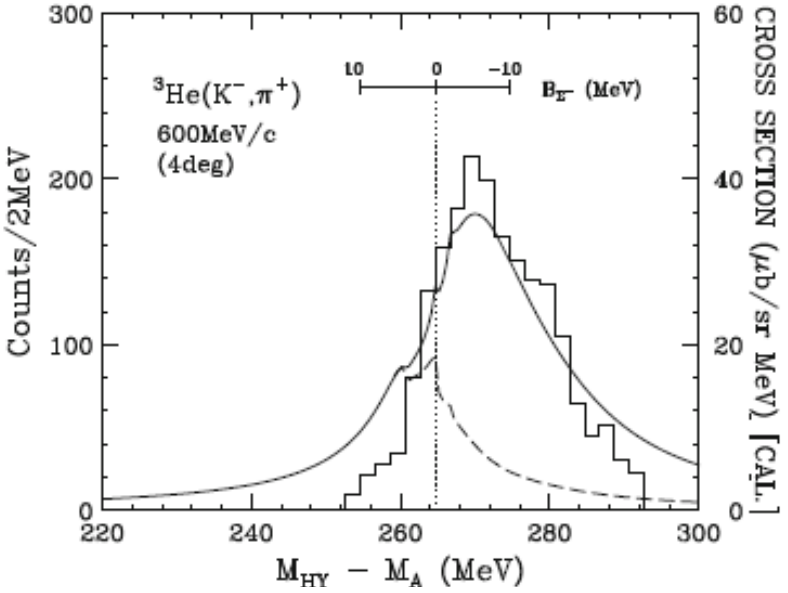




High Light in D01: High Density NS matter

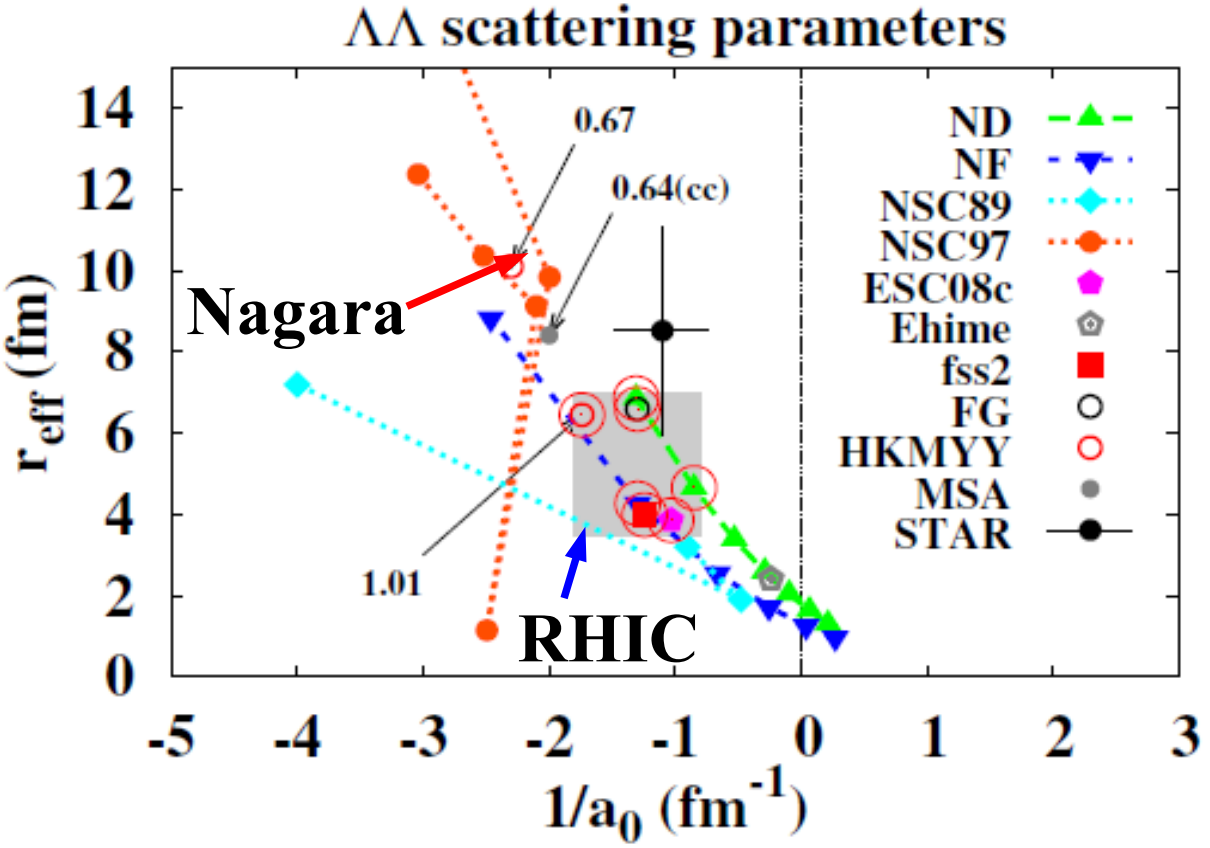
- **Relativistic Mean Field with Three-body coupling**
  [Tsubakihara, A. Ohnishi, Nucl. Phys. A914 (2013), 438]
  - **RMF with three-body coupling is given to be consistent both with hypernuclear data and massive neutron stars.**
- **Three-body systems with strangeness**
  [T. Harada, Y. Hirabayashi, Few-Body Syst (2013) 54:1205]
  - **Pole structure is examined in ΣNN channel, which gives information on ΛNN three-body force.**
- **Λ hyperon as a probe of triaxial deformation**
  [M. Isaka, M. Kimura, A. Dote, A. Ohnishi, Phys. Rev. C 87 (2013), 021304(R)]

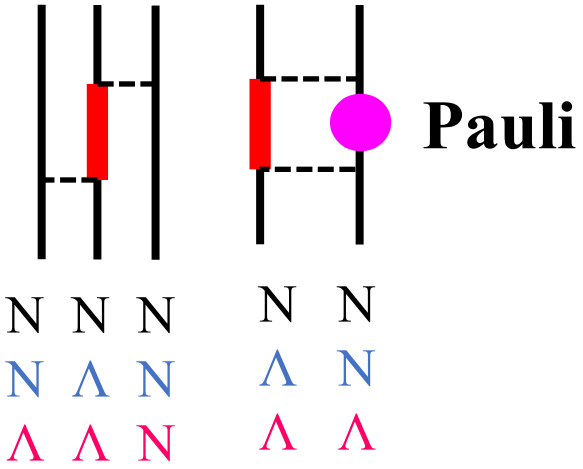




Do we see ΛΛN interaction ?

- $V_{\Lambda\Lambda}$ from RHIC is more attractive than $V_{\Lambda\Lambda}$ from Nagara
  - If this shows medium effects, we find a hint to ΛΛN int.
  - Pauli blocking in the intermediate state is a promising candidate of universal three-body repulsion.
    (Kohno ('14)/ Myint, Shinmura, Akaishi ('03) / Nishizaki, Takatsuka, Yamamoto('02))





Thank you for your attention.