Отчет за 5 лет

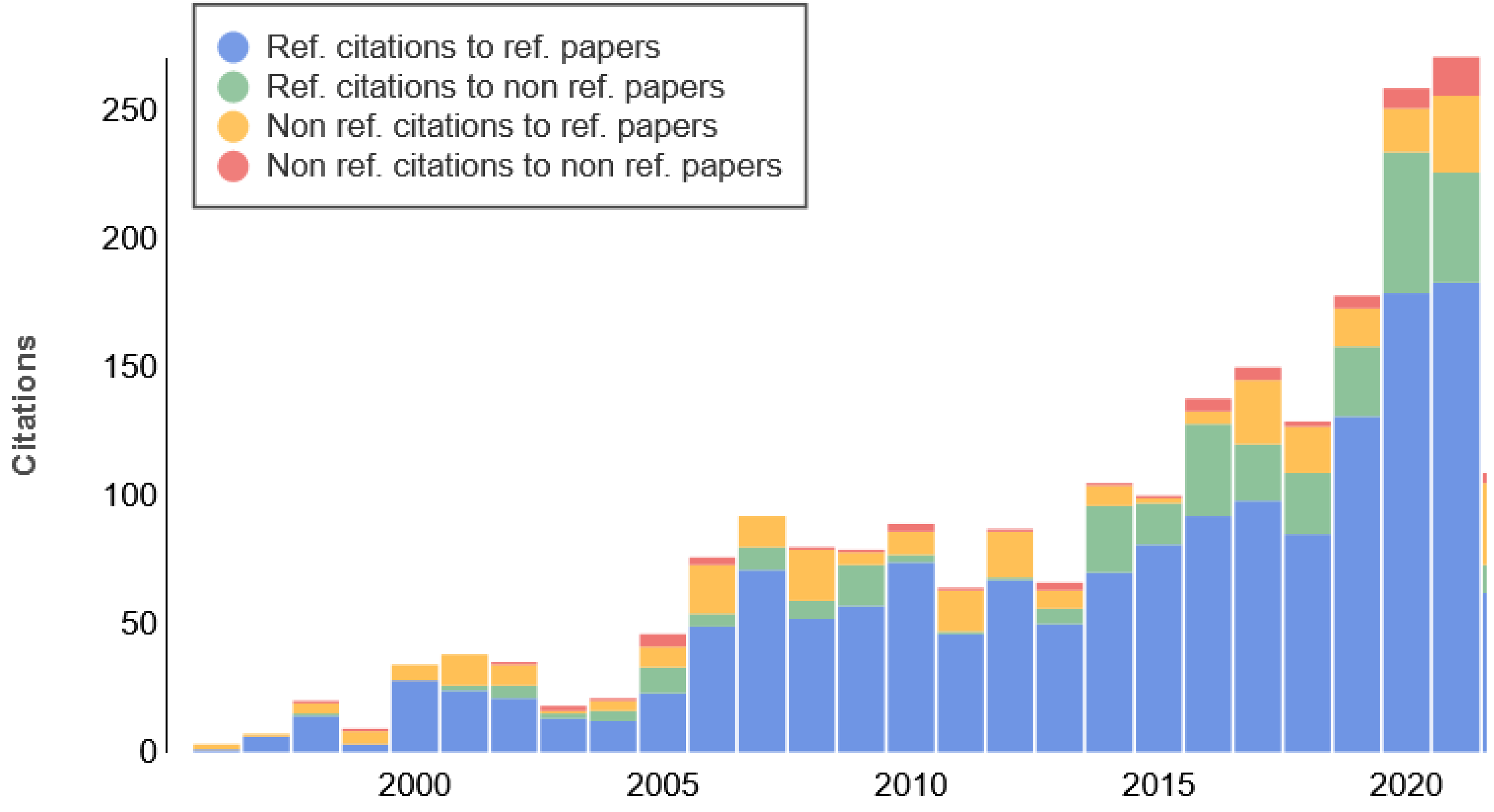
СЕРГЕЙ ПОПОВ

Общая статистика

За 2017-2021 гг.

- Всего >30 публикаций
- Из них 13 высокорейтинговых
- ~20 докладов на конференциях
- Защитилось 5 дипломников (+курсовые)
- Прочитано (в МГУ) ~20 семестровых курсов
  (физфак, астрономическое отделение и ФКИ),
  плюс 3 года (2018-2021) преподавания на физфаке ВШЭ.
- Просветительская работа – лекции и тп.
  (куратор раздела «Вселенная в Политехническом музее)
- Опубликовано 2 научно-популярные книги

Статистика по NASA ADS

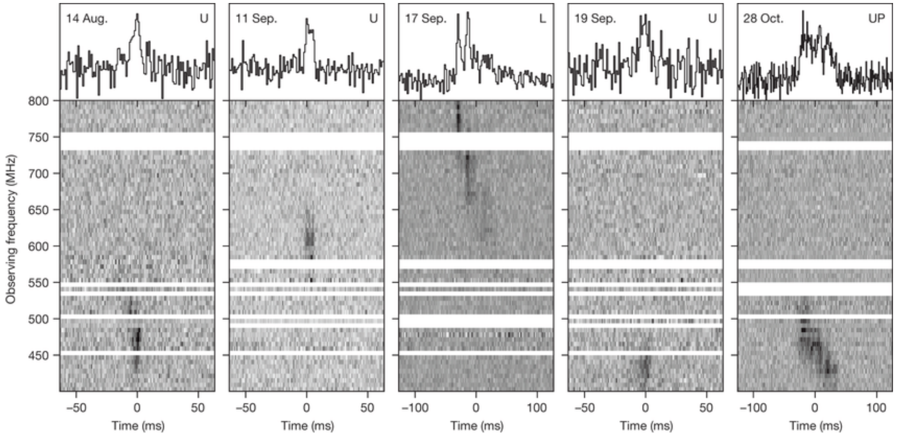


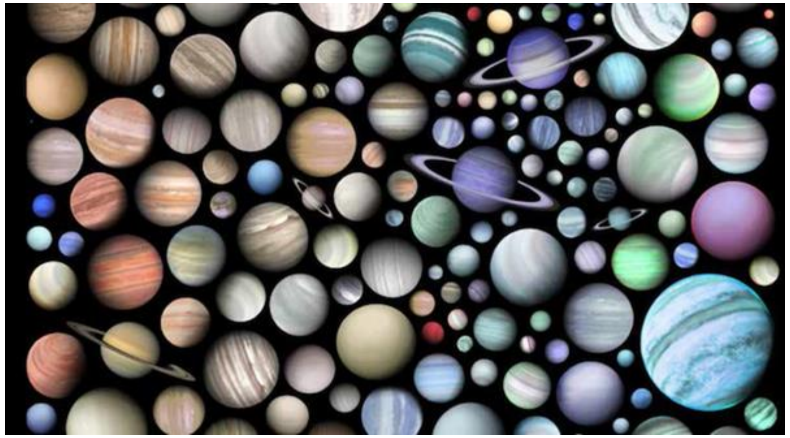
	Totals
Number of citing papers	1443
Total citations	2303
Number of self-citations	495
Average citations	12.1
Median citations	4
Normalized citations	865.6
h-index	27
i100-index	5

Данные на 17 марта

Основные темы работ

- Свойства и эволюция нейтронных звезд
- Быстрые радиовсплески
- Экзопланеты





Обзоры

- S.B. Popov, K.A. Postnov, M.S. Pshirkov
  ``Fast radio bursts''
  Physics Uspekhi vol. 61 N.10 pp. 1063 - 1079 (2018)
- P. Tinyakov, M.S. Pshirkov, S.B. Popov
  `` Astroparticle Physics with Compact Objects''
  Universe vol. 7. id. 401 (2021)
- A.P. Igoshev, S.B. Popov, R. Hollerbach
  ``Evolution of neutron star magnetic fields''
  Universe vol. 7, id. 351 (2021)

Экзопланеты

- A.V. Popkov, S.B. Popov
  ``Coalescence rate of exoplanets with stars due to tidal evolution and stellar evolution after Main Sequence''
  Bull. Crimean Astrophys. Observ. v. 114, pp. 70-74 (2018)
- O. Kulikova, S.B. Popov, V.V. Zhuravlev
  ``Planet migration in wind-fed accretion disks in binaries''
  MNRAS vol. 487, pp. 3069-3078 (2019)
- A.V. Popkov, S.B. Popov
  ``The Rate of Planet-star Coalescences Due to Tides and Stellar Evolution''
  MNRAS vol. 490, pp. 2390 - 2404 (2019)
- A.S. Andryushin, S.B. Popov
  ``Population synthesis of exoplanets accounting for orbital changes due to stellar evolution''
  Astronomy reports vol. 65, pp. 246-268 (2021)
- E.V. Bekesov, A.A. Belinskii, S.B. Popov
  ``Software to Determine the Sizes and Orbital Inclinations of Planets from the Transit Observation Data''
  Astronomy reports vol. 65, pp. 1278-1291 (2021)

Быстрые радиовсплески (minor contribution)

- A. Ridnaia, D. Svinkin, D. Frederiks, A. Bykov, S.B. Popov, R. Aptekar, S. Golenetskii, A. Lysenko, A. Tsvetkova, M. Ulanov, T. Cline
  ``A peculiar hard X-ray counterpart of a Galactic fast radio burst''
  Nature Astronomy vol. 5, pp. 372-377 (2021)
- M. Lyutikov, S.B. Popov
  ``Fast Radio Bursts from reconnection events in magnetar magnetospheres''
  arXiv: 2005.05093
- M.S. Pshirkov, S.B. Popov, I.Yu. Zolotukhin
  ``Search for periodic emission from magnetars in the M31 galaxy in the XMM-Newton data''
  Astronomy Letters vol. 47, pp. 12-18 (2021)

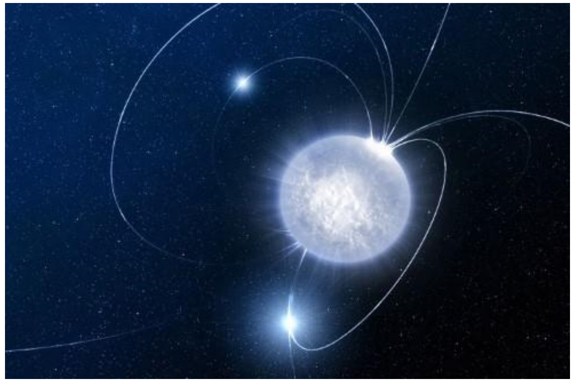
Быстрые радиовсплески

- S.B. Popov, K.A. Postnov, M.S. Pshirkov
  ``Fast radio bursts: superpulsars, magnetars, or something else?''
  IJMPD, v. 27, id. 1844016 (2018)
- M.S. Pshirkov, S.B. Popov, K.A. Postnov
  ``Fast radio bursts: a new major puzzle in astrophysics''
  in: Particle Physics at the Silver Jubilee of Lomonosov Conferences:
  Proceedings of the 18th Lomonosov Conference on Elementary Particle Physics.
  Ed. A. Studenikin. World Scientific, Singapour
  pp. 293-296 (2019)
- A.D. Khokhryakova, D.A. Lyapina, S.B. Popov
  ``On the possibility of registering X-ray flares related to fast radio bursts with the SRG/eROSITA telescope''
  Astronomy Letters vol. 45, pp. 120-126 (2019)
- S.B. Popov
  ``Origin of sources of repeating fast radio bursts with periodicity in close binary systems''
  Research Notes AAS vol. 4, id 98 (2020)

Нейтронные звезды (minor contribution)

- A. Zhuravlev, S.B. Popov, M.S. Pshirkov
  ``Photon-axion mixing in thermal emission of isolated neutron stars"
  Physics Letters B vol. 821, id. 136615 (2021)
- D. De Grandis, R. Taverna, R. Turolla, A. Gnarini, S. B. Popov, S. Zane, T. S. Wood
  ``X-ray Emission from Isolated Neutron Stars revisited: 3D magnetothermal simulations"
  ApJ vol. 914, id. 118 (2021)
- A.P. Igoshev, S.S. Tsygankov, M. Rigoselli, S. Mereghetti, S.B. Popov, J.G. Elfritz, A. A. Mushtukov
  ``Discovery of X-rays from the old and faint pulsar J1154--6250"
  ApJ vol. 865, id. 116 (2018)
- A. Drago, G. Pagliara, S.B. Popov, S. Traversi, G. Wiktorowicz
  ``The merger of two compact stars: a tool for dense matter nuclear physics"
  Universe v. 4, p. 50 (2018)
- G. Wiktorovicz, A. Drago, G. Pagliara, S.B. Popov
  ``Strange quark stars in binaries: formation rates, mergers and explosive phenomena"
  ApJ vol. 846, pp. 163-172 (2017)

Нейтронные звезды



- S.B. Popov, R. Taverna, R.Turolla
  ``Probing the surface magnetic field structure in RX J1856.5-3754''
  MNRAS vol. 464, pp. 4390-4398 (2017)
- S.B. Popov, A.P. Igoshev, R. Taverna, R. Turolla
  ``Looking for Hall attractor in astrophysical sources''
  Journal of Physics: Conference Series vol. 932, p. 012048 (2017)
- S.B. Popov, A.A. Kaurov, A.D. Kaminker
  ``Magnetic field evolution of neutron stars: linking magnetars and anti-magnetars''
  in: ``Particle Physics at the Year of Light'', Proceedings of the Seventeenth Lomonosov Conference on Elementary Particle Physics (World Scientific), pp. 345-349 (2017)
- A. Gonzalez-Galan, L. M. Oskinova, S. B. Popov, F. Haberl, M. Kuehnel, J. S. Gallagher III et al.
  ``A multi-wavelength study of SXP 1062, the long period X-ray pulsar associated with a supernova remnant''
  MNRAS vol. 475, pp. 2809-2821 (2018)
- A.P. Igoshev, S.B. Popov
  ``How to make a mature accreting magnetar''
  MNRAS vol. 473 pp. 3204-3210 (2018)

Нейтронные звезды

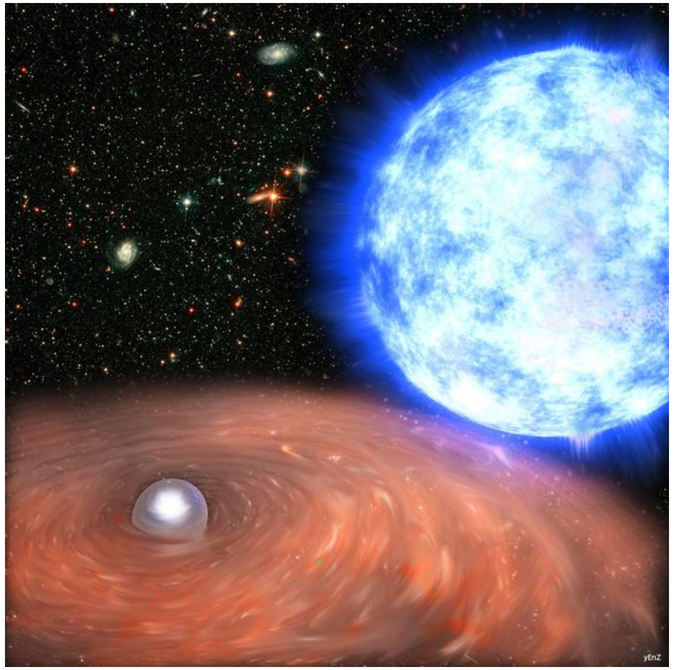
- A.P. Igoshev, S.B. Popov
``Braking indices of young radio pulsars: theoretical perspective''
MNRAS vol. 499, pp.2826-2835 (2020)
- A.P. Igoshev, S.B. Popov
``Magnetic field decay in young radio pulsars''
AN vol. 342, pp. 216-221 (2021)
- A.P. Igoshev, S.B. Popov
``Is PSR J0250+5854 at the Hall attractor stage?''
Research Notes AAS vol. 2, id 171 (2018)
- A.D. Khokhriakova, S.B. Popov
``Detectability of neutron star white dwarf coalescences by eROSITA and ART-XC''
J. of High Energy Astroph. vol. 24, pp. 1-5 (2019)
- A.D. Khokhryakova, A.V. Biryukov, S.B. Popov
``Observability of single neutron stars at SGR/eROSITA''
Astronomy reports vol. 65, pp. 615-630 (2021)

Other papers

- A. Toporensky, O. Zalslavskii, S. Popov
  ``Unified approach to redshift in cosmological /black hole spacetimes and synchronous frame''
  Eur. J. Phys. vol. 39 p.015601 (2018)
- S.B. Popov, S. Mereghetti, S.I. Blinnikov, A.G. Kuranov, L.R. Yungelson
  ``A young contracting white dwarf in the peculiar binary HD 49798/RX J0648.0-4418?''
  MNRAS vol. 474 pp. 2750-2756 (2018)
- A.D. Khokhriakova, S.B. Popov
  ``Detectability of neutron star white dwarf coalescences by eROSITA and ART-XC''
  J. of High Energy Astroph. vol. 24, pp. 1-5 (2019)

2022 papers

- A. Chaikova, D. Kostyunin, S.B. Popov
  ``Model-independent classification of events from the first CHIME/FRB Fast Radio Burst catalog ''
  arXiv: 2202.10076
- A.D. Khokhriakova, A.V. Biryukov, S.B. Popov
  ``Observability of isolated neutron stars at SRG/eROSITA''
  Proc. IAU Symp. 363 (in press)
- S.B. Popov
  ``High magnetic field neutron stars and magnetars in binary systems''
  Proc. IAU Symp. 363 (in press)
- D. Khangulyan, M.V. Barkov, S. B. Popov
  ``Fast radio bursts by high-frequency synchrotron maser emission generated at the reverse shock of a powerful magnetar flare''
  ApJ vol. 927, id. 2 (2022)
- A.D. Khokhryakova, S.B. Popov
  ``Origin of young accreting neutron stars in high-mass X-ray binaries in supernova remnants''
  MNRAS vol. pp. 4447 - 4453 (2022)

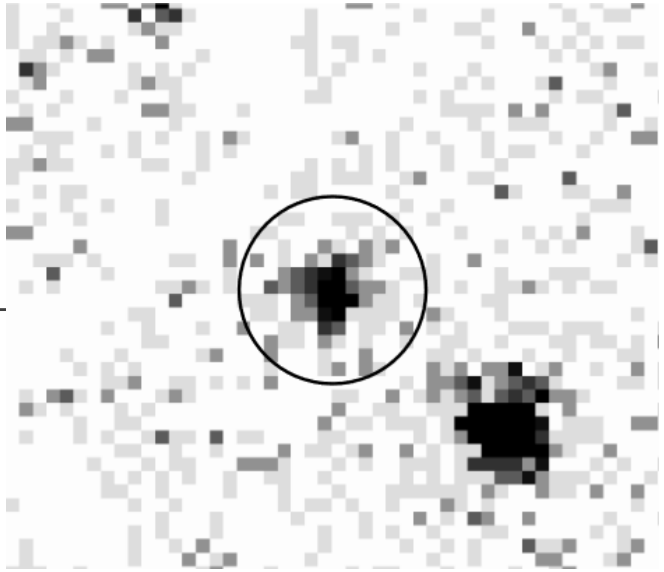


HD 49798: First contracting WD

S.POPOV, S. MEREGHETTI, S. BLINNIKOV, A. KURANOV, L. YUNGELSON

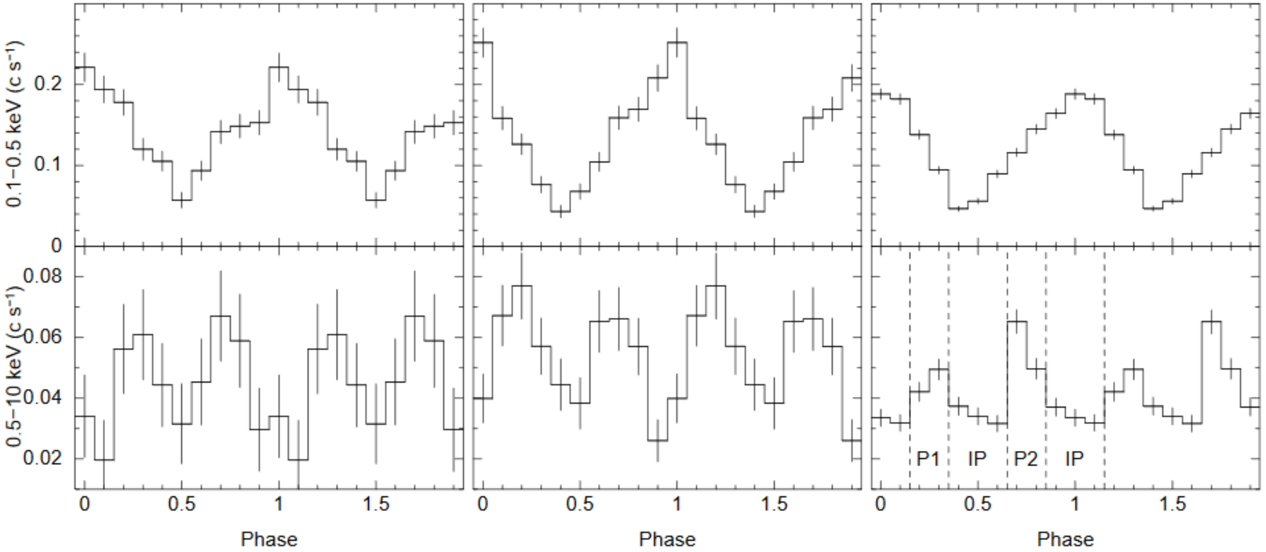
MNRAS (2018) ARXIV: 1711.02449

System parameters



Parameter	Value	Units
Right Ascension	$6^h\ 48^m\ 4.7^s$	J2000
Declination	$-44^\circ\ 18'\ 58.4''$	J2000
Orbital period	1.547666(2)	d
A_X sin i	9.79(19)	light-s
T*	43961.243(15)	MJD
ν_0	0.0758480846(1)	Hz
$\dot{\nu}$	$1.24(2) \times 10^{-17}$	Hz s^{-1}
P_0	13.18424856(2)	s
$\dot{P}$	$-2.15(5) \times 10^{-15}$	s s^{-1}
T_0	48937. 7681361	MJD
M_X	1.28(5)	$M_\odot$
M_C	1.50(5)	$M_\odot$

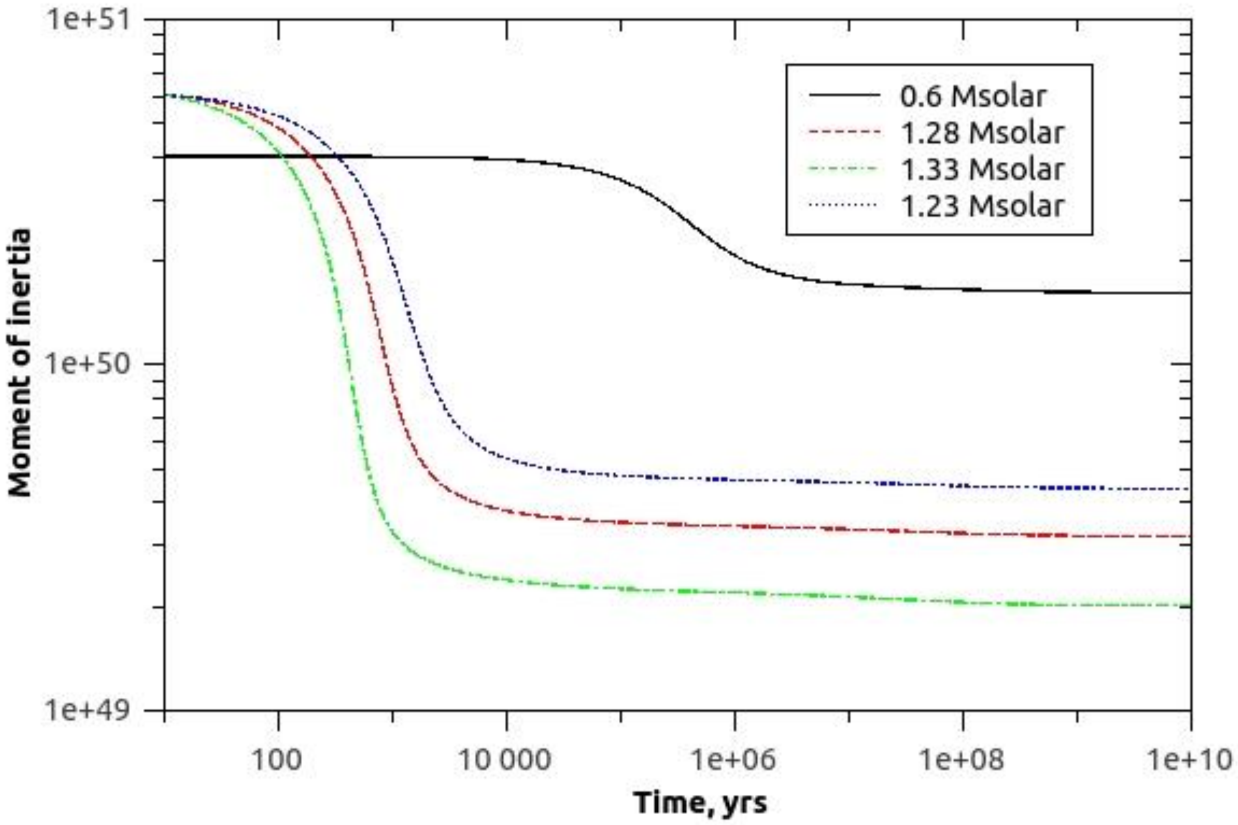
Mereghetti et al. (2016) 1603.01505



Mereghetti et al. (2011) 1105.6227

Evolution of the moment of inertia

$$I = \frac{8\pi}{3}\int_0^R \rho r^4 dr,$$



WD properties

To fit all data the WD might have:

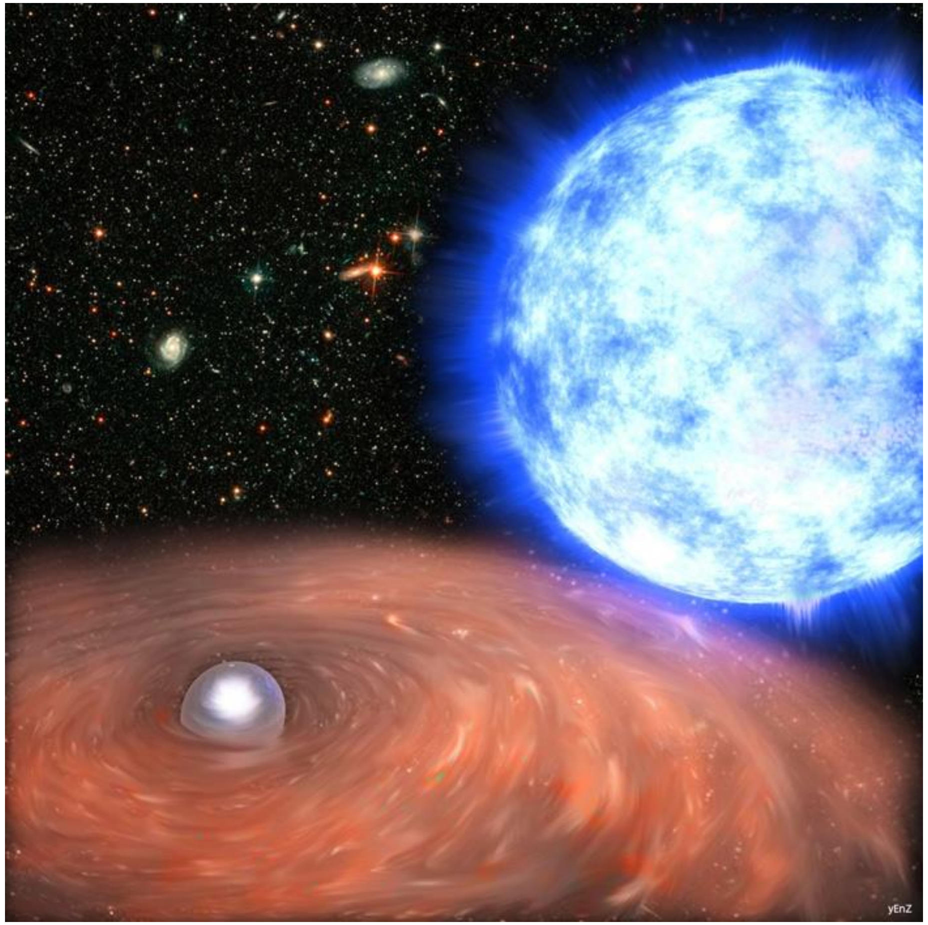
M=1.28 Msolar

Age ~ 2 Myrs (1<Age<5 Myrs)

This corresponds to

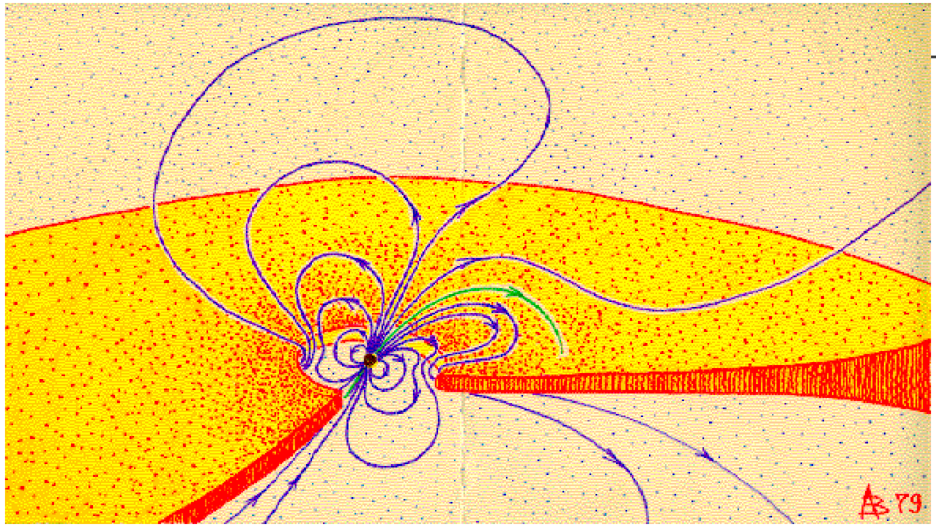
- radius 3340 km
- temperature 75 000K

Luminosity of the sdO star is much larger ~10^4 Lsolar.

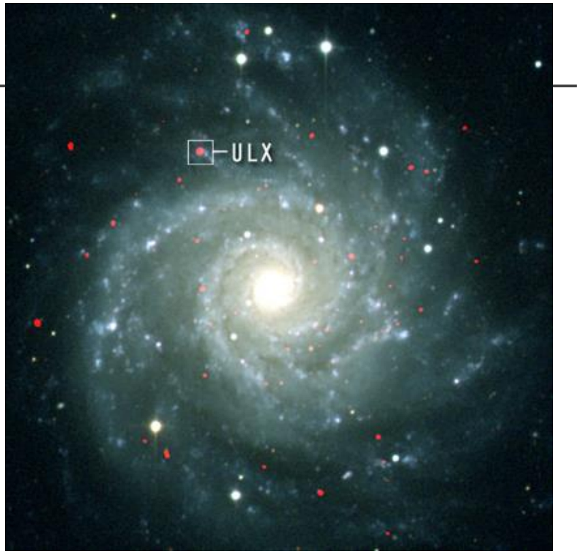


Accreting magnetars

Typically magnetic fields of neutron stars in accreting X-ray binaries are estimated with indirect methods.

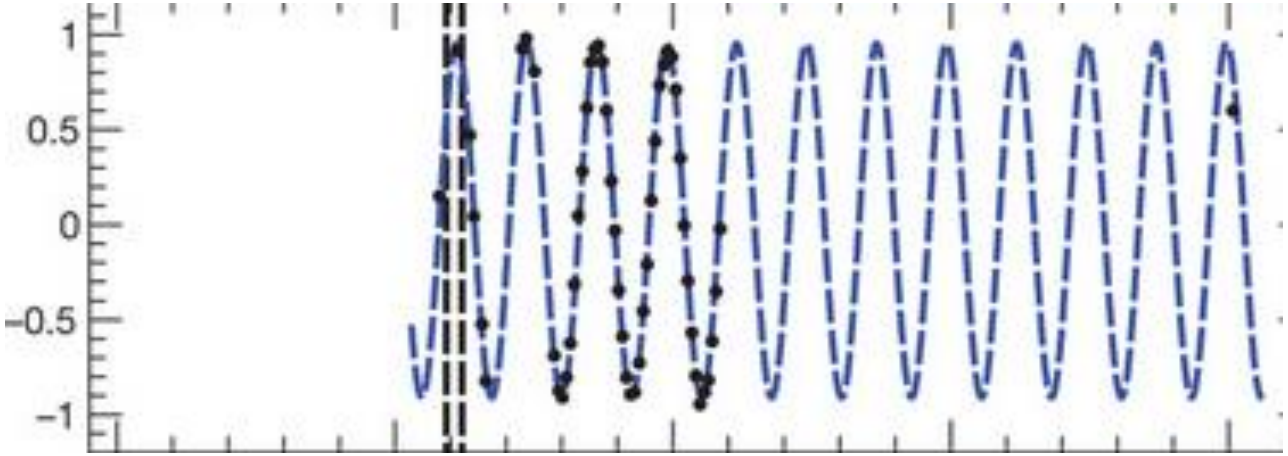


- Spin-up
- Spin-down
- Equilibrium period
- Accretion model
- …….

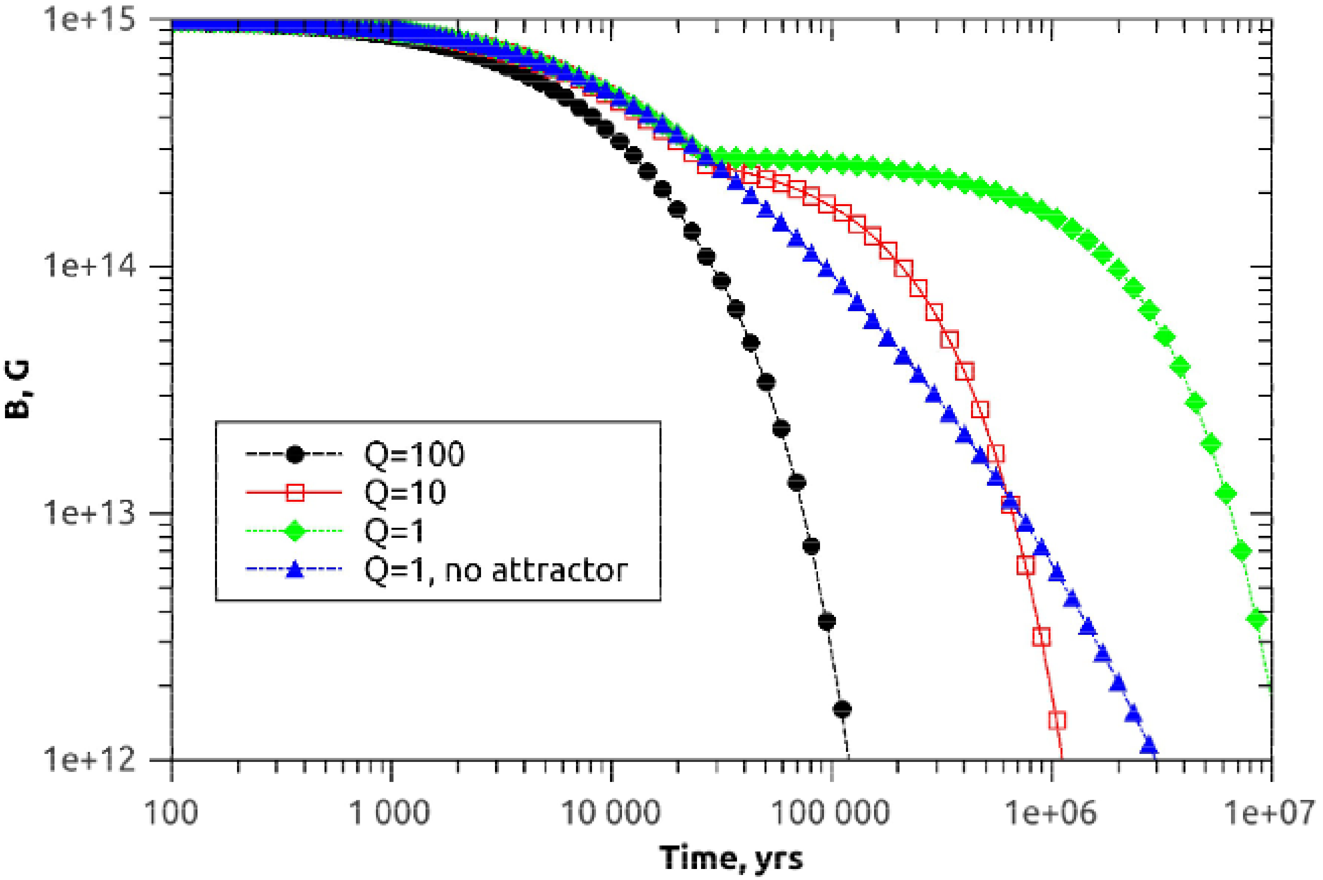


- ULX. NuSTAR J095551+6940.8 (M82 X-2). Ekşi et al. (2015).
- ULX. NGC 5907. Israel et al. (2017a)
- ULX. NGC 7793 P13. Israel et al. (2017b).
- 4U0114+65. Sanjurjo et al. (2017).
- 4U 2206+54. Ikhsanov & Beskrovnaya (2010).
- SXP1062. Fu & Li (2012)
- Swift J045106.8-694803. Klus et al. (2013).

1709.10385



How to make an accreting magnetar?

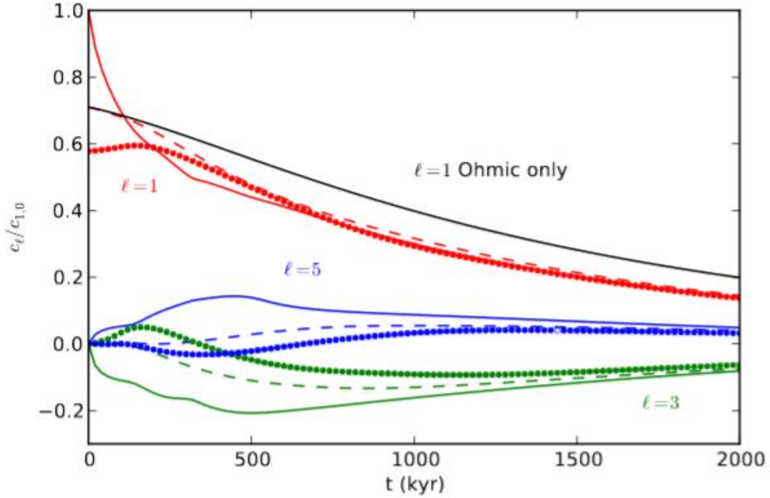


Igoshev, Popov 1709.10385

Three conditions are necessary:

1. Hall attractor;
2. Rapid cooling of the crust;
3. Low values of Q.

Hall attractor:



Gourgouliatos, Cumming 1311.7004

Pulsar timing

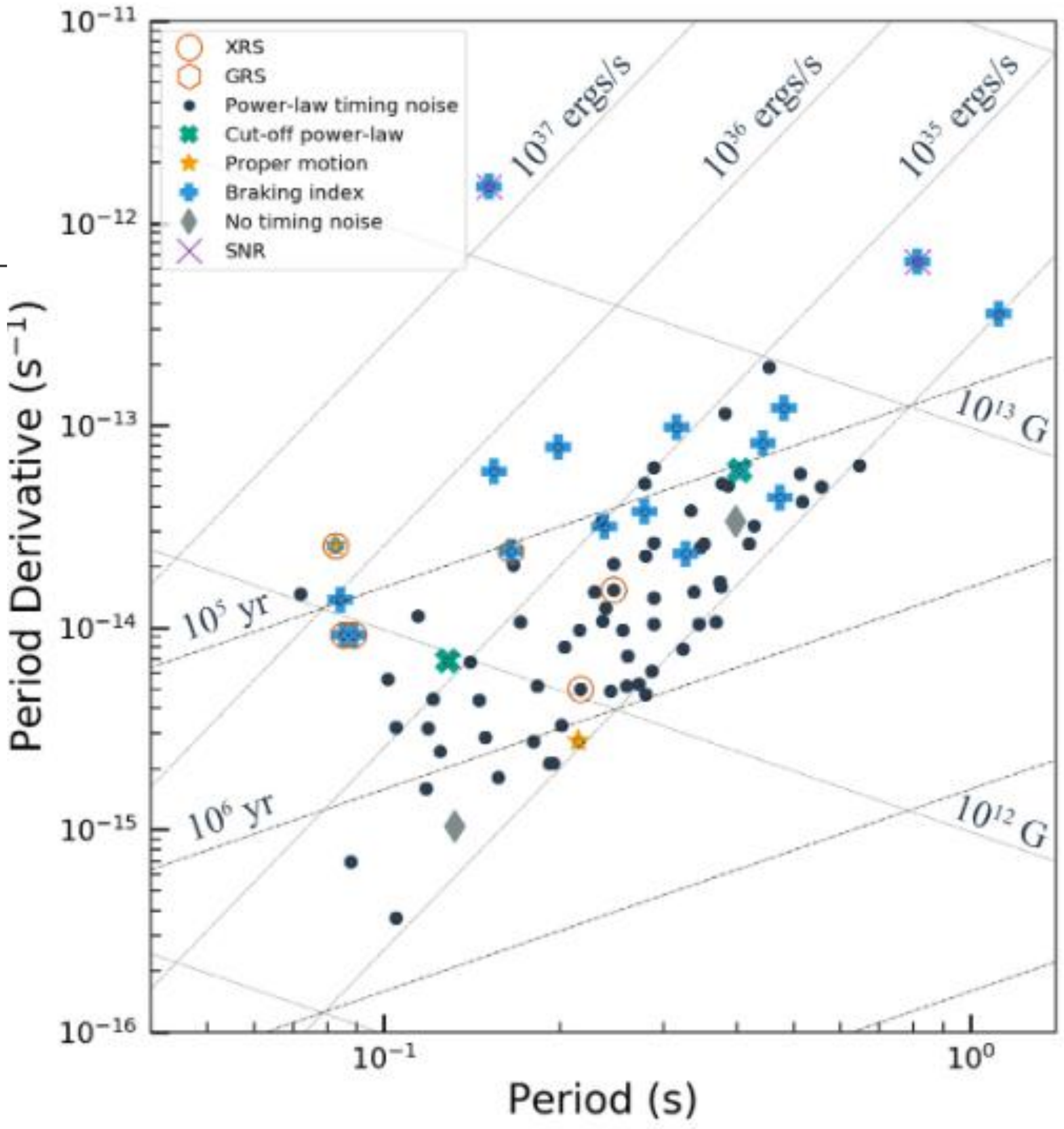
Andrei Igoshev, Sergei Popov

MNRAS vol. 499, pp.2826-2835 (2020)
Astron. Nach. vol. 342, pp. 216-221 (2021)

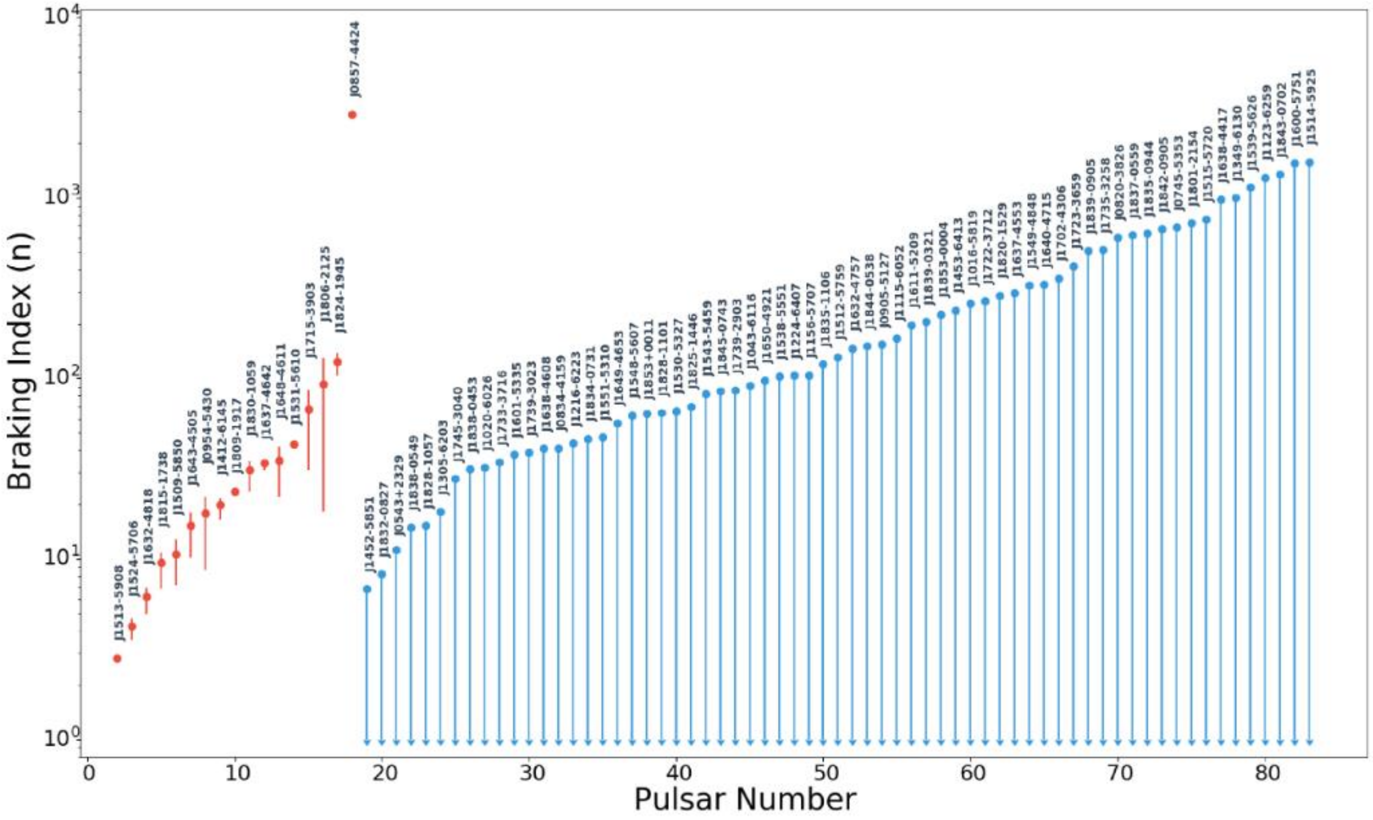
Parthasarathy et al. (2019)
presented detailed timing of 85 pulsars.

For many of them
braking indices were measured.

We analyze different approaches
to explain these results,
and conclude that the best explanation
is related to an episode of field decay
in young, still relatively hot, NSs.



Braking index measurements



$$n = \frac{\Omega \ddot{\Omega}}{\dot{\Omega}^2} = 2 - \frac{P \ddot{P}}{\dot{P}^2}.$$

$$P\dot{P} = \frac{2}{3}\beta B_p^2$$

where β is:

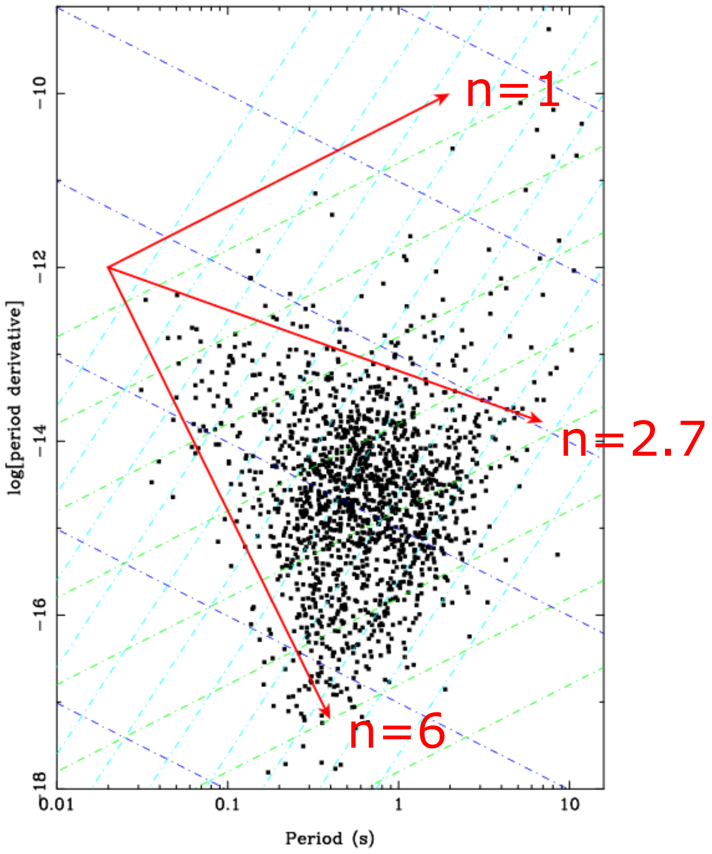
$$\beta = \frac{\pi^2 R_{\rm NS}^6}{I c^3},$$

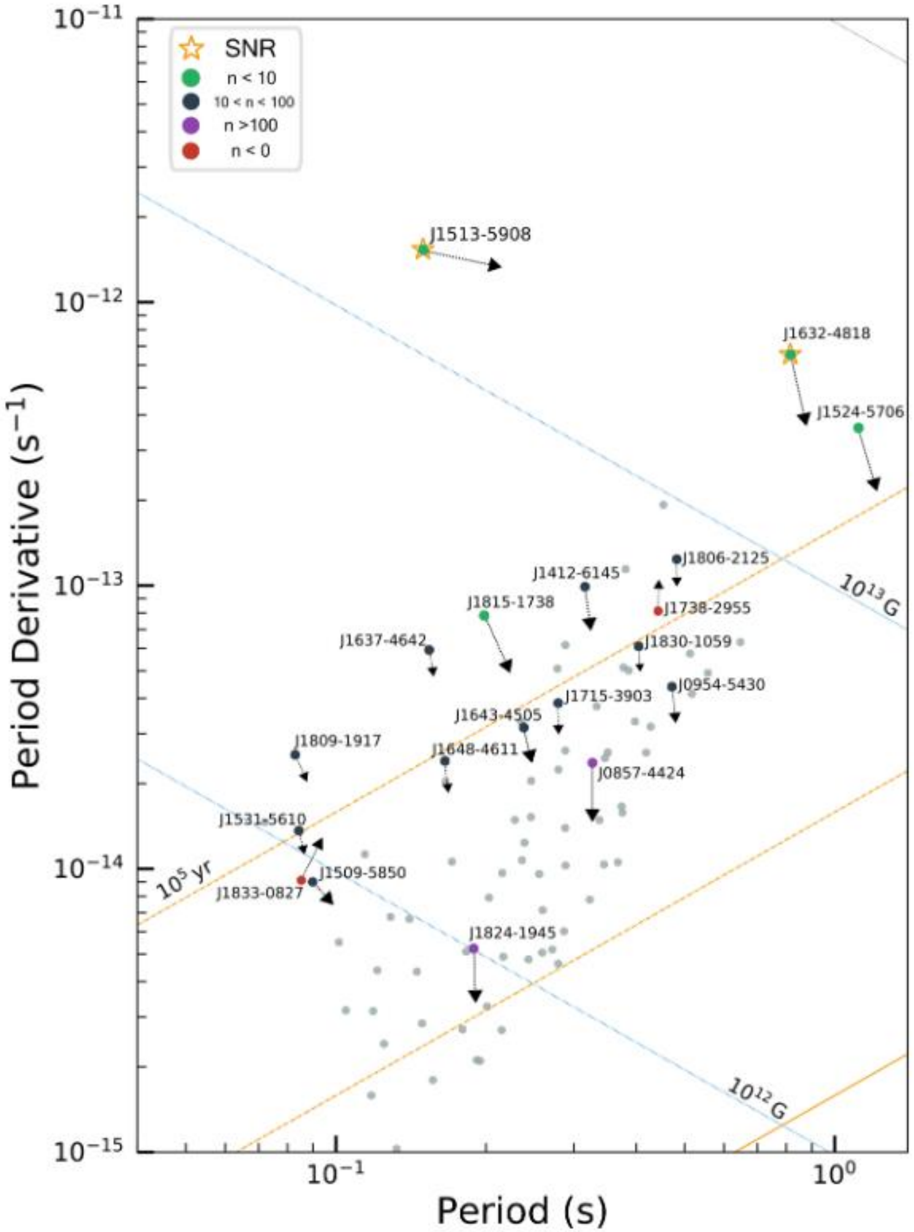
Parthasarathy et al. (2020) MNRAS 494, 2012

Braking and P-Pdot

For constant field n=3.
n>3 can be an indication of decaying fields.

1702.03616





Parthasarathy et al. (2020) MNRAS 494, 2012

Large braking indices due to field decay

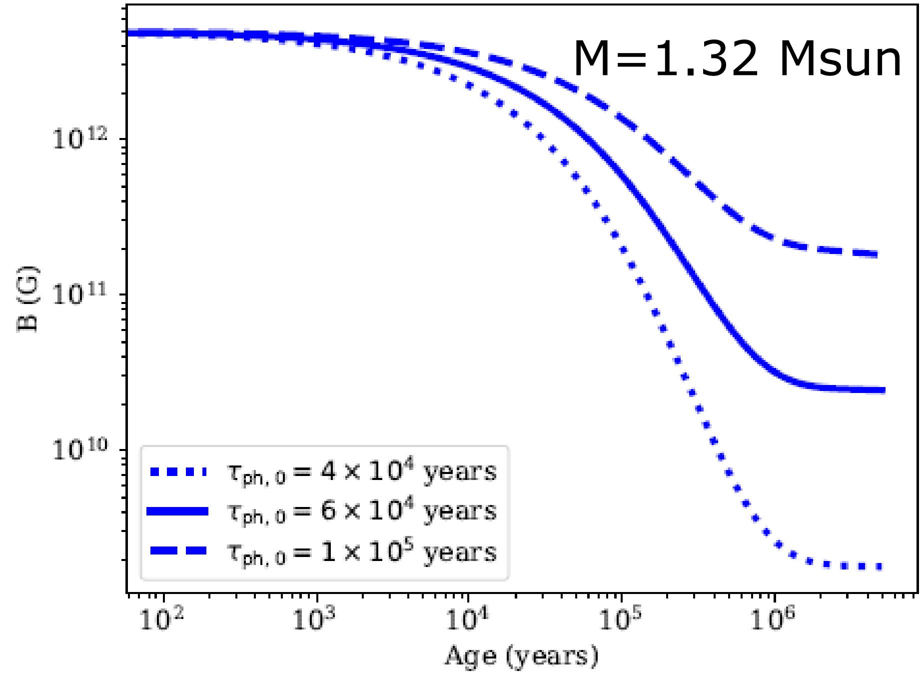
$$\tau_{\rm ph} = 2.2\,{\rm Myr}\,\frac{\rho_{14}^{15/6}}{T_8^2}\left(\frac{Y_{\rm e}}{0.05}\right)^{5/3}\left(\frac{Y_{\rm n}}{0.8}\right)^{10/3}\left(\frac{f}{0.5}\right)^{2}\left(\frac{g_{14}}{2.45}\right)^{-2} =$$

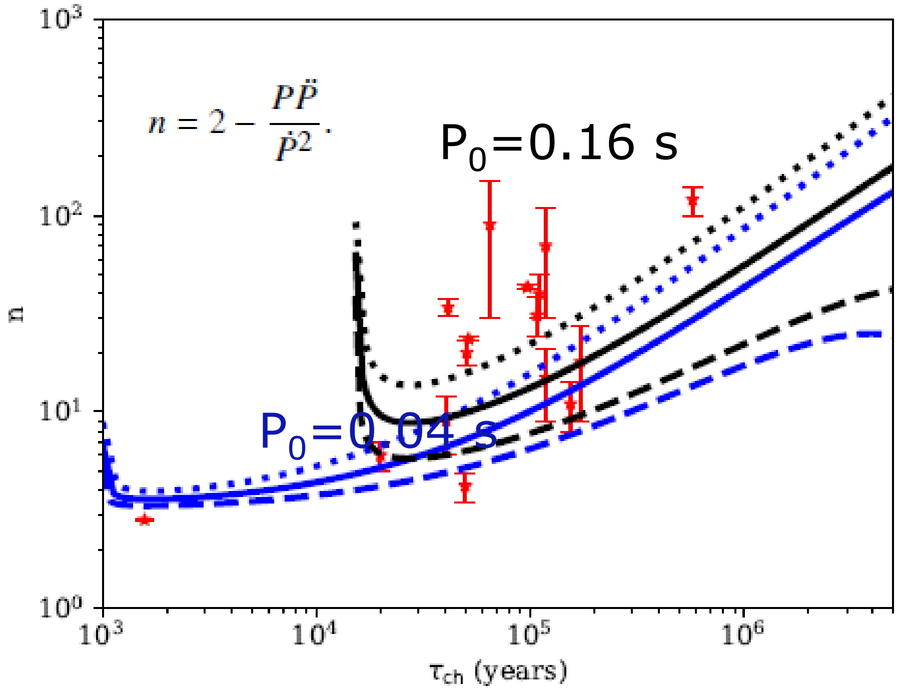
$$= \frac{\tau_{\rm ph,0}}{T_8^2} \qquad (13)$$

$$n = 3 - 2\frac{P}{\dot{P}}\frac{\dot{B}_p}{B_p}.$$

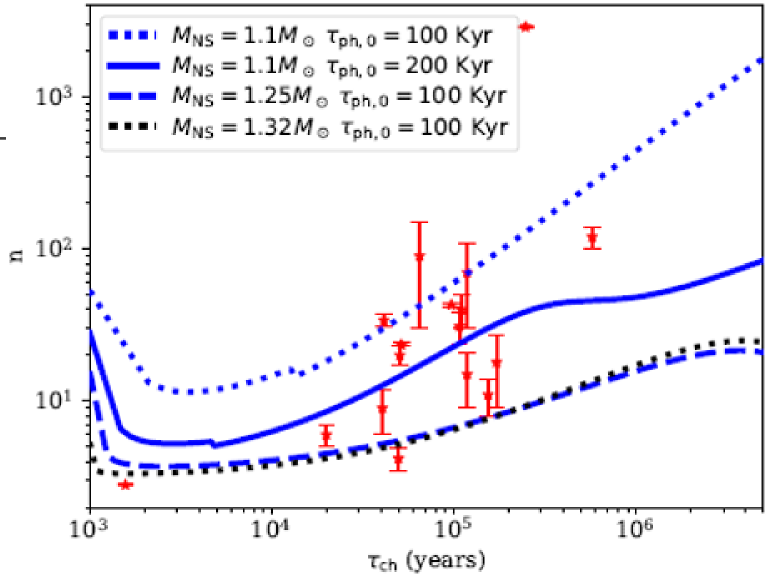
$$n = 3 + 2\frac{P}{\dot{P}}\frac{1}{\tau_{\rm Ohm}}.$$

$$n = 3 + 4\frac{\tau_{\rm ch}}{\tau_{\rm Ohm}}.$$





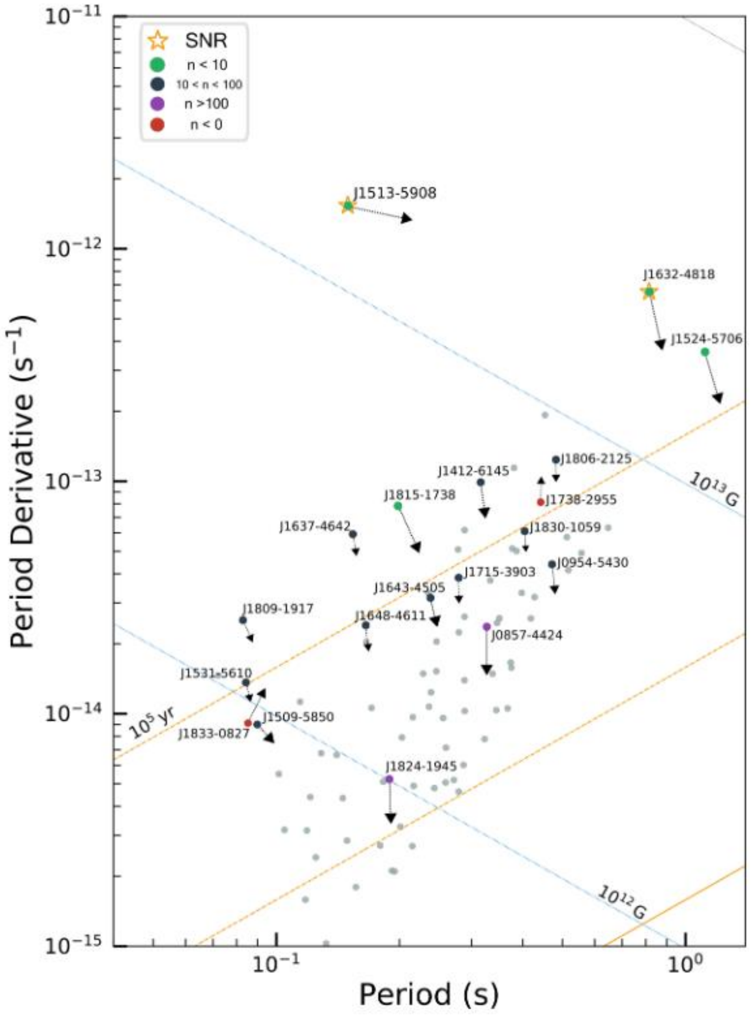
What we have



We analyzed different models
to explain large braking indices
recently measured for a sample
of normal radio pulsars.

We conclude that these results
can be better explained in the model
of magnetic field decay in low-mass NSs
due to scatter of electrons off crystal phonons.

These findings are in correspondence with our previous results
on magnetic field decay in young normal radio pulsars.



Планы на будущее

- Исследование эволюции нейтронных звезд
  - эволюция магнитного поля
  - одиночные аккрецирующие нейтронные звезды
  - fallback и свойства нейтронных звезд
- Участие в разработке и анализе моделей FRB
- Экзопланеты
  - миграция в дисках двойных систем (Некрасов)
  - взаимодействие планет со звездами (Лазовик)