

# リサーチコネクト


## Re:Dive

-キヤルちゃんの論文チェック、その裏側-

キヤルちゃん

06/01/2023

# 自己紹介

- キャルちゃん(とtwitterでは名乗らせていただいております)
- (量子)アニーリング, 組合せ最適化, 量子回路 @ Jij Inc.
- 大学院生時代
  - 磁気流体計算で銀河磁場の研究
  - スパコンで走らせるソフトウェアをC言語で開発
  - アウトリーチ活動
- 結婚を機に🇺🇸ユタ州に移住 (2020年8月~)
-  : <https://twitter.com/tweetnakasho>
- website: <https://github-nakasho.github.io>

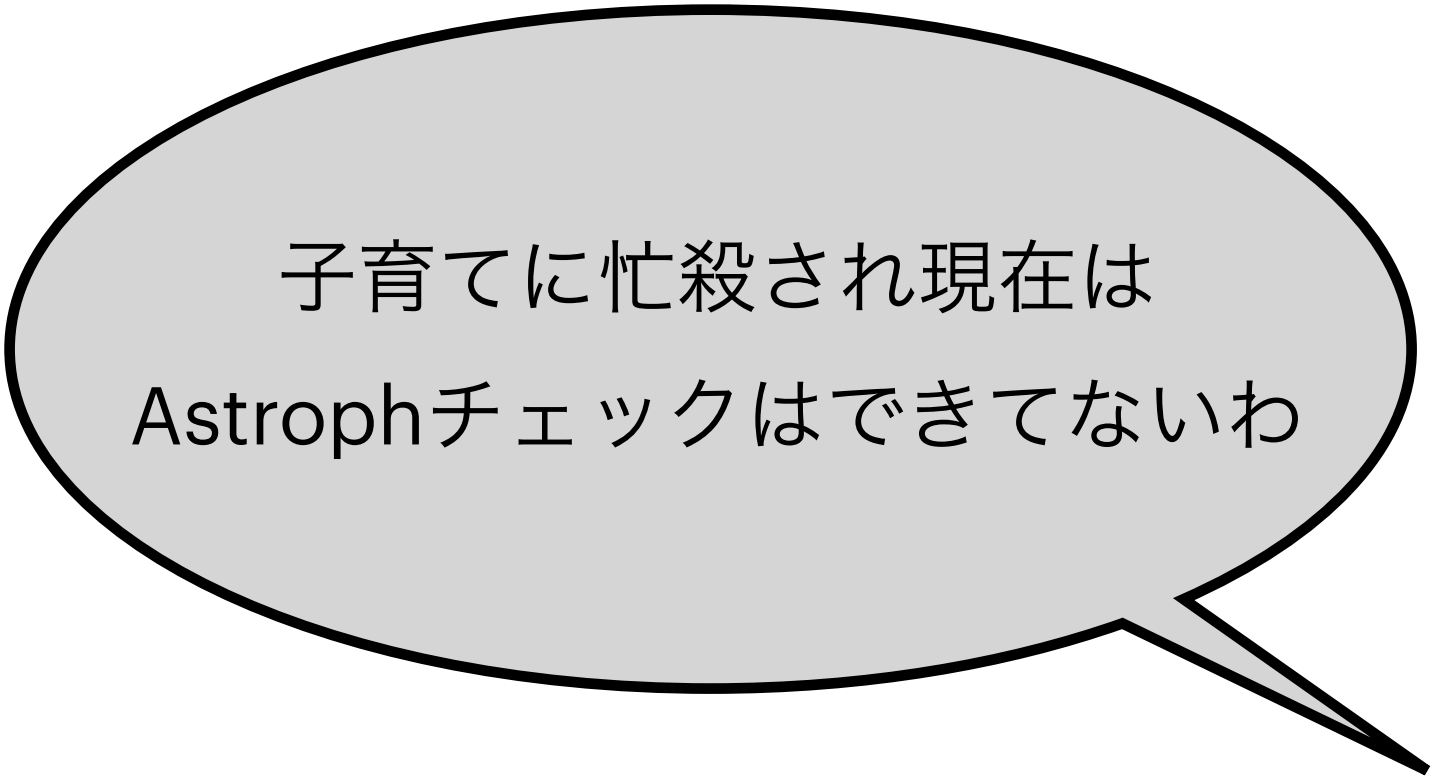
# Outline

- キャルちゃんの論文チェック
- ArXivとは
- 論文チェックの仕方
- 例を実演
- 論文を読んだ後は...
- 結言

キヤルちゃんの論文チェック

# キヤルちゃんの論文チェックとは？

- astrophチェック: 宇宙物理系のarXiv新着論文チェック  
~~毎日夜7時(日本時間では昼10時)ごろTwitter TLに流す~~
- quantphチェック: 量子情報系のarXiv新着論文チェック  
毎日昼過ぎ3時(日本時間では朝6時)ごろTwitter TLに流す



子育てに忙殺され現在は  
Astrophチェックはできてないわ

# キヤルちゃんの論文チェックのメリット

- どんな研究が世界で行われているかのキャッチアップ
- 世の中より先に知識を仕入れることができる
- Twitterでみんなから注目される (たまにプチバズする)

勉強のモチベーションは  
人それぞれよね

#キヤルちゃんのquantphチェック  
ルービックキューブを表現するルービック群をユニタリ表現し、その幾何学的制約からルービックキューブを量子論的に記述。ルービックキューブの角はボソン、辺はフェルミオンのように振る舞うことを示し、さらにこれを深層強化学習で解いた。  
[arxiv.org/abs/2109.07199](https://arxiv.org/abs/2109.07199)

Figure 1: (a) The different kind of cubies composing the Cube: in light blue, in pink and in grey the edges, the corners and the centrals respectively. The arrows define the arbitrary choice of orientation for the solved state. Two different colours are applied for corners (pink) and edges (blue). (b) The faces of the Cube with their conventional colours, blue, red and white. Coordinated axes are introduced to describe the positions of the cubies, and the choice for the orientation in the solved configuration for the cubies. (c) The same conventional axes.

Figure 2: Schematic representation of a F transformation, i.e. a rotation of the frontal (red) layer as from Figure 1. The position of each cubie can be described by three quantum numbers,  $n_x, n_y$  and  $n_z$ , each of them is set to be zero in the solved configuration of the Cube. (a) Effect of the F rotation (rotation of the frontal red layer of Figure 1) on the corners by a translation for each corner. The d cubie is moved along the x-axis of one position from its solved position, which is labelled by raising the quantum number  $n_x$  by one ( $n_x$  is now +1). Conversely, e is translated in the opposite direction along the y-axis by one position, which means its quantum number  $n_y$  will be lowered by one ( $n_y$  is now -1). (b) Effect of the F rotation by nine degrees.

Figure 6: (a) A scheme of the neural network architectures deployed during the training of the agent in the four phases. The frames on the left represent the possible values the input neuron can assume, for example for the edge moments (above) and the corner spin (bottom). For each phase of the training, the input neurons assume a precise spectrum of values. On the right, the output neurons assume the label of a precise action the agent is able to take. (b) Scheme

午前9:53 · 2021年9月16日 · Twitter Web App


|| ツイートアクティビティを表示

プロモーションする

153 件のリツイート 27 件の引用ツイート 569 件のいいね

# キヤルちゃんの論文チェックのデメリット

- 自分の時間が取られる (他にやりたいことがあるのに...)
- 正しく要約できているか不安になる (英語力とその分野の理解)
- 純粹に日々続けるのが辛かったりする



まあ人間だものね

ArXivとは



# チェックしているwebsite

- アーカイブ: <https://arxiv.org/>
- 世界中の人が査読済み論文や研究ノート・講義ノートを投稿している
- 査読というシステムがないので、信頼性は査読雑誌よりは低い？

The screenshot shows the arXiv website homepage. At the top left is the Cornell University logo. The arXiv logo is prominently displayed in the center. On the right, there is a search bar with a dropdown menu set to 'All fields' and a 'Search' button. Below the search bar, there is a 'Login' link. A red banner at the top right contains the text: 'We gratefully acknowledge support from the Simons Foundation and member institutions.' Below the search bar, there is a 'Subject search and browse:' section with a dropdown menu set to 'Physics' and buttons for 'Search', 'Form Interface', and 'Catchup'. A 'News' section follows, with a link to 'arXiv's blog'. A 'COVID-19 Quick Links' section is highlighted in red, containing links to 'arXiv' and 'medRxiv and bioRxiv'. An 'Important' notice states: 'e-prints posted on arXiv are not peer-reviewed by arXiv; they should not be relied upon without context to guide clinical practice or health-related behavior and should not be reported in news media as established information without consulting multiple experts in the field.' The 'Physics' section lists various sub-fields with links to 'new', 'recent', and 'search' pages, including Astrophysics, Condensed Matter, General Relativity and Quantum Cosmology, High Energy Physics (Experiment, Lattice, Phenomenology, Theory), Mathematical Physics, Nonlinear Sciences, Nuclear Experiment, Nuclear Theory, Physics, and Quantum Physics.

# ArXivの分類

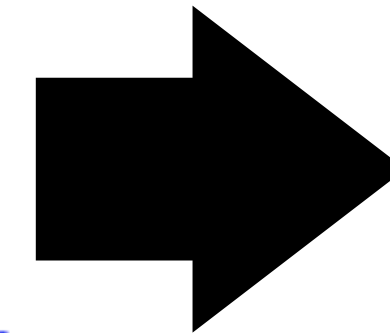
- Physics  
(Astrophysics, Condensed Matter, General Relativity and Quantum Cosmology, High Energy Physics, Mathematical Physics, Nonlinear Science, Nuclear Physics, Physics, Quantum Physics)
- Mathematics
- Computer Science
- Quantitative Biology
- Statistics
- Electrical Engineering and System Science
- Economics

# チェックしている場所

- アーカイブの“new”の部分

## Physics

- [Astrophysics \(astro-ph new recent, search\)](#)  
includes: [Astrophysics of Galaxies](#); [Cosmology and Nongalactic Astrophysics](#); [Earth and Planetary Astrophysics](#)
- [Condensed Matter \(cond-mat new recent, search\)](#)  
includes: [Disordered Systems and Neural Networks](#); [Materials Science](#); [Mesoscale and Nanoscale Physics](#); [Superconductivity](#)
- [General Relativity and Quantum Cosmology \(gr-qc new recent, search\)](#)
- [High Energy Physics - Experiment \(hep-ex new recent, search\)](#)
- [High Energy Physics - Lattice \(hep-lat new recent, search\)](#)
- [High Energy Physics - Phenomenology \(hep-ph new recent, search\)](#)
- [High Energy Physics - Theory \(hep-th new recent, search\)](#)
- [Mathematical Physics \(math-ph new recent, search\)](#)
- [Nonlinear Sciences \(nlin new recent, search\)](#)  
includes: [Adaptation and Self-Organizing Systems](#); [Cellular Automata and Lattice Gases](#); [Chaotic Dynamical Systems](#)
- [Nuclear Experiment \(nucl-ex new recent, search\)](#)
- [Nuclear Theory \(nucl-th new recent, search\)](#)
- [Physics \(physics new recent, search\)](#)  
includes: [Accelerator Physics](#); [Applied Physics](#); [Atmospheric and Oceanic Physics](#); [Atomic and Molecular Physics](#); [Biological Physics](#); [Fluid Dynamics](#); [General Physics](#); [Geophysics](#); [History and Philosophy of Physics](#); [Instrumentation and Detectors](#)
- [Quantum Physics \(quant-ph new recent, search\)](#)



## Astrophysics

### New submissions

Submissions received from Tue 15 Mar 22 to Wed 16 Mar 22, announced Thu, 17 Mar 22

- [New submissions](#)
- [Cross-lists](#)
- [Replacements](#)

[ total of 101 entries: 1-101 ]  
[ showing up to 2000 entries per page: [fewer](#) | [more](#) ]

### New submissions for Thu, 17 Mar 22

[1] [arXiv:2203.08151](#) [[pdf](#), [other](#)]

#### Magnetic Field Reversal around an Active Fast Radio Burst

[S. Dai](#), [Y. Feng](#), [Y. P. Yang](#), [Y. K. Zhang](#), [D. Li](#), [C. H. Niu](#), [P. Wang](#), [M. Y. Xue](#), [B. Zhang](#), [S. Burke-Cruces](#), [G. Hobbs](#), [C. C. Miao](#), [J. R. Niu](#), [M. D. Filipovic](#), [S. Q. Zhu](#)

Comments: Submitted

Subjects: [High Energy Astrophysical Phenomena \(astro-ph.HE\)](#); [Astrophysics of Galaxies \(astro-ph.GA\)](#)

The environment of actively repeating fast radio bursts (FRBs) has been shown to be complex and vary in second FRB source associated with a compact, persistent radio source (PRS). The main tracer of the magnetic field and electron density, which does not allow a direct probe of the B-field configuration. Here we report directly measured B-field configuration in or around the FRB could be due to the vicinity of massive black holes, or a magnetic field configuration that has changed from  $\sim 10000 \text{ rad m}^{-2}$  to  $\sim -16000 \text{ rad m}^{-2}$  between June 2021 and January 2022. Such extra

[2] [arXiv:2203.08152](#) [[pdf](#), [other](#)]

#### CMB lensing power spectrum with next generation surveys

[Louis Legrand](#), [Julien Carron](#)

Comments: Contribution to the 2022 Cosmology session of the 56th Rencontres de Moriond, 2 pages, 2 figures

Subjects: [Cosmology and Nongalactic Astrophysics \(astro-ph.CO\)](#)

We introduce a new estimator of the CMB lensing power spectrum, together with its likelihood, based on standard quadratic estimator. Most importantly, it is unbiased towards the assumptions done on the noise compared to the quadratic estimator, while keeping numerical cost under control and being robust to errors

[3] [arXiv:2203.08153](#) [[pdf](#), [other](#)]

#### NGC 1605 is not a binary cluster

[Friedrich Anders](#), [Alfred Castro-Ginard](#), [Iuan Casado](#), [Carme Jordi](#), [Lola Balaquer-Núñez](#)

# チェックしている場所

- New submissions: そのトピックスに沿った投稿論文
- Cross-lists: そのトピックスがメインではないが、サブとして入っている投稿論文 (例: メインはgr-qcだが、天体物理も絡むのでastro-phも入っているなど)
- Replacements: 以前に投稿されたものの再投稿



## Astrophysics

### New submissions

*Submissions received from Tue 15 Mar 22 to Wed 16 Mar 22, announced Thu, 17 Mar 22*

- [New submissions](#)
- [Cross-lists](#)
- [Replacements](#)

# ArXivに掲載される本数

- Astroph: 平均50-70本 (多い日で100本越え)
  - > その中から個人的に面白いと思ったものを5-8本くらい抽出
- Quantph: 平均20-40本 (多い日で60本くらい)
  - > 同じく10-20本くらい抽出

# 論文チェックの仕方

# 論文チェックの流れ

## 1. Titleを読む

New submissions for Thu, 17 Mar 22

[1] [arXiv:2203.08151](#) [pdf, other]

### Magnetic Field Reversal around an Active Fast Radio Burst

S. Dai, Y. Feng, Y. P. Yang, Y. K. Zhang, D. Li, C. H. Niu, P. Wang, M. Y. Xue, B. Zhang, S. Burke-Spolaor, C. J. Law, R. S. Lynch, L. Connor, R. Anna-Thomas, L. Zhang, R. Duan, J. M. Yao, C. W. Tsai, W. W. Zhu, M. Cruces, G. Hobbs, C. C. Miao, J. R. Niu, M. D. Filipovic, S. Q. Zhu

Comments: Submitted

Subjects: **High Energy Astrophysical Phenomena (astro-ph.HE)**; Astrophysics of Galaxies (astro-ph.GA)

The environment of actively repeating fast radio bursts (FRBs) has been shown to be complex and varying. The recently localized FRB 20190520B is extremely active, has the largest confirmed host dispersion measure, and is only the second FRB source associated with a compact, persistent radio source (PRS). The main tracer of the magneto-ionic environments is the rotation measure (RM), a path-integral of the line-of-sight component of magnetic field strength (B) and electron density, which does not allow a direct probe of the B-field configuration. Here we report direct evidence for a B-field reversal based on the observed sign change and extreme variation of FRB 20190520B's RM, which changed from  $\sim 10000 \text{ rad m}^{-2}$  to  $\sim -16000 \text{ rad m}^{-2}$  between June 2021 and January 2022. Such extreme RM reversal has never been observed before in any FRB nor in any astronomical object. The implied short-term change of the B-field configuration in or around the FRB could be due to the vicinity of massive black holes, or a magnetized companion star in binary systems, or a young supernova remnant along the line of sight.

[2] [arXiv:2203.08152](#) [pdf, other]

### CMB lensing power spectrum with next generation surveys

Louis Legrand, Julien Carron

Comments: Contribution to the 2022 Cosmology session of the 56th Rencontres de Moriond, 2 pages, 2 figures

Subjects: **Cosmology and Nongalactic Astrophysics (astro-ph.CO)**

We introduce a new estimator of the CMB lensing power spectrum, together with its likelihood, based on iterative lensing reconstruction. Despite the increased complexity of the lensing maps, this estimator shares similarities with the standard quadratic estimator. Most importantly, it is unbiased towards the assumptions done on the noise and cosmology for the lensing reconstruction. This new spectrum estimator can double the constraints on the lensing amplitude compared to the quadratic estimator, while keeping numerical cost under control and being robust to errors.

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### NGC 1605 is not a binary cluster

Friedrich Anders, Alfred Castro-Ginard, Juan Casado, Carme Jordi, Lola Balaguer-Núñez

Comments: Accepted by RNAAS. 2 pages, 1 figure. Online material here: [this https URL](#)

Subjects: **Astrophysics of Galaxies (astro-ph.GA)**; Solar and Stellar Astrophysics (astro-ph.SR)

The open star cluster NGC 1605 has recently been reported to in fact consist of two clusters (one intermediate-aged and one old) that merged via a flyby capture. Here we show that Gaia data do not support this scenario. We also report the serendipitous discovery of a new open cluster, Can Batll'o 1, with a similar age and distance.

[4] [arXiv:2203.08155](#) [pdf, other]

### Weak Mass Loss from the Red Supergiant Progenitor of the Type II SN 2021yja

Griffin Hosseinzadeh, Charles D. Kilpatrick, Yize Dong, David J. Sand, Jennifer E. Andrews, K. Azalee Bostroem, Daryl Janzen, Jacob E. Jencson, Michael Lundquist, Nicolás Meza, Jeniveve Pearson, Stefano Valenti, Samuel Wvatt, Jamison Burke, Daichi Hiramatsu, D. Andrew Howell, Curtis McCully, Megan Newsome, Estefania Padilla Gonzalez, Craig Pellarino, Giacomo Terreran, Katie Auchettl, Kyle W. Davis, Ryan I. Foley, Hao-

# 論文チェックの流れ

2. Titleを読んで「面白そう」「自分に必要」と感じたら、abstractを読む  
(Titleだけで判断できなければabstractで判断しても良い)

New submissions for Thu, 17 Mar 22

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## Magnetic Field Reversal around an Active Fast Radio Burst

[S. Dai](#), [Y. Feng](#), [Y. P. Yang](#), [Y. K. Zhang](#), [D. Li](#), [C. H. Niu](#), [P. Wang](#), [M. Y. Xue](#), [B. Zhang](#), [S. Burke-Spolaor](#), [C. J. Law](#), [R. S. Lynch](#), [L. Connor](#), [R. Anna-Thomas](#), [L. Zhang](#), [R. Duan](#), [J. M. Yao](#), [C. W. Tsai](#), [W. W. Zhu](#), [M. Cruces](#), [G. Hobbs](#), [C. C. Miao](#), [J. R. Niu](#), [M. D. Filipovic](#), [S. Q. Zhu](#)

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Comments: Accepted by RNAAS. 2 pages, 1 figure. Online material here: [this https URL](#)

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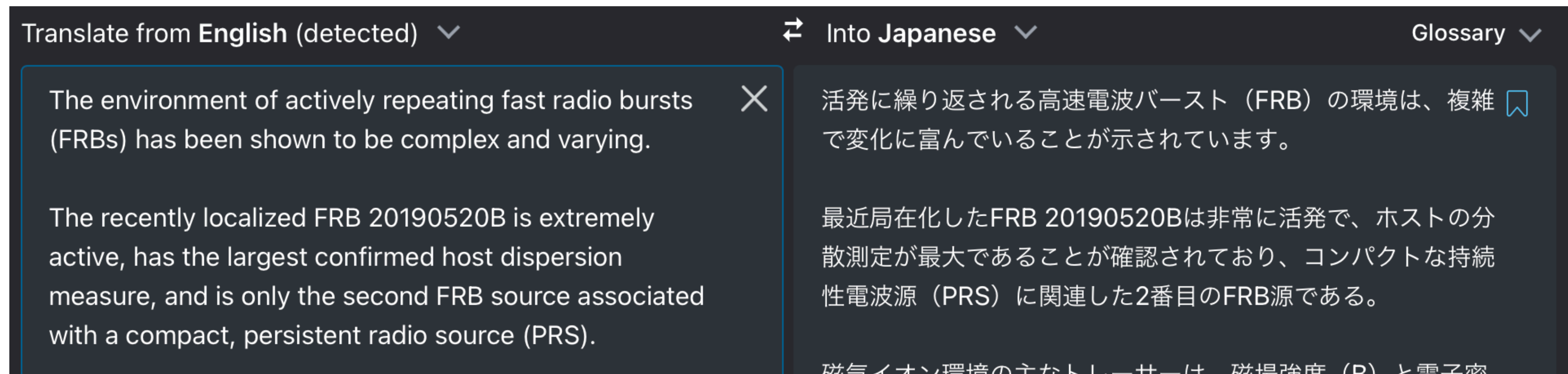
# 論文チェックの流れ

## 3. 躊躇なく abstractをDeepLにぶち込む

(専門用語やカンマ区切りの多い文章などは正しく訳せない場合があるので、日本語と英語を照らし合わせながら読む)

(論文のabstractは1000-1500字程度、DeepLは無料で5000字まで翻訳可能)

(DeepLの画面で見やすいように改行を入れると良い)





# 論文チェックの流れ

\* そもそもどれを読んで良いかわからなければ...

論文が掲載された雑誌・著者などで判断しても良い (非推奨...だが良く使う手)

Nature Astronomy: 14.4

Astrophysical Journal Letters (ApJL): 8.2

Astrophysical Journal (ApJ): 5.9

Astronomy & Astrophysics (A&A): 5.8

Monthly Notices of the Royal Astronomical Society (MNRAS): 5.3

Physical Review D: 5.3

Publications of the Astronomical Society of Japan (PASJ): 5.0

[8] [arXiv:2203.08162](#) [pdf, other]

**Using the Hills Mechanism to Generate Repeating Partial Tidal Di**  
[M. Cufari, Eric R. Coughlin, C. J. Nixon](#)

Comments: 6 pages, 1 figure, and 1 table. Resubmitted to ApJL following first referee report

Subjects: High Energy Astrophysical Phenomena (astro-ph.HE)

Periodic nuclear transients have been detected with increasing frequency, with one source are generated by the repeated partial disruption of a star, but how the star was integrations to demonstrate that the Hills mechanism, where a binary system is destroyed radius of one of the stars within the binary. Thus, Hills capture can produce stars on the ASASSN-14ko, but for periodic nuclear transients in general. We also show that the rate indicating that in this system there must be additional effects that contribute to the de observable period decay rates in future events.

例を実演

# 例: Magnetic Field Reversal around an Active Fast Radio Burst

The environment of actively repeating fast radio bursts (FRBs) has been shown to be complex and varying.

The recently localized FRB 20190520B is extremely active, has the largest confirmed host dispersion measure, and is only the second FRB source associated with a compact, persistent radio source (PRS).

The main tracer of the magneto-ionic environments is the rotation measure (RM), a path-integral of the line-of-sight component of magnetic field strength (B) and electron density, which does not allow a direct probe of the B-field configuration.

Here we report direct evidence for a B-field reversal based on the observed sign change and extreme variation of FRB 20190520B's RM, which changed from  $\sim 10000 \text{ rad m}^{-2}$  to  $\sim -16000 \text{ rad m}^{-2}$  between June 2021 and January 2022.

Such extreme RM reversal has never been observed before in any FRB nor in any astronomical object.

The implied short-term change of the B-field configuration in or around the FRB could be due to the vicinity of massive black holes, or a magnetized companion star in binary systems, or a young supernova remnant along the line of sight.

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The main method for measuring the magnetic field (B-field) configuration is the rotation measure (RM), a path-integral of the B-field along the line of sight, which does not allow a direct probe of the B-field configuration.

Here we report direct evidence for a B-field reversal based on the observed sign change and extreme variation of FRB 20190520B's RM, which changed from  $\sim 10000$  rad  $m^{-2}$  to  $\sim -16000$  rad  $m^{-2}$  between June 2021 and January 2022.

Such extreme RM reversal has never been observed before in any FRB nor in any astronomical object.

The implied short-term change of the B-field configuration in or around the FRB could be due to the vicinity of massive black holes, or a magnetized companion star in binary systems, or a young supernova remnant along the line of sight.

一番言いたいのはココ

We report/find/show/propose/provide/demonstrate ...などは特に重要

# 例: Magnetic Field Reversal around an Active Fast Radio Burst

The environment of actively repeating fast radio bursts (FRBs) has been shown to be complex and varying.

The recently localized FRB 20190520B is extremely active, has the largest confirmed host dispersion measure, and is only the second FRB source associated with a compact, persistent radio source (PRS).

The main tracer of the magneto-ionic environments is the rotation measure (RM), a path-integral of the line-of-sight component of magnetic field strength (B) and electron density, which does not allow a direct probe of the B-field configuration.

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Such extreme RM reversal has never been observed for any astronomical object.

The implied short-term change of the B-field around FRB 20190520B could be due to the vicinity of massive black holes, or a magnetized companion star in binary systems, or a young supernova remnant along the line of sight.

ここまでは研究の背景  
これまででわかっていること、  
これまでの研究の問題や未解決部分など

# 例: Magnetic Field Reversal around an Active Fast Radio Burst

The environment of actively repeating fast radio bursts (FRBs) has been shown to be complex and varying.

The recently localized FRB 20190520B is extremely active, has the largest confirmed host dispersion measure, and is only the second FRB source associated with a compact, persistent radio source (PRS).

The main tracer of the magneto-ionic environments is the rotation measure (RM), a path-integral of the line-of-sight component of magnetic field strength (B) and electron density, which does not allow a direct probe of the B-field configuration.

Here we report direct evidence for a B-field reversal based on the observed sign change and extreme variation of FRB 20190520B's RM, which varied from  $\sim 16000$  rad  $m^{-2}$  to  $\sim -16000$  rad  $m^{-2}$  between June 2019 and July 2019.

Such extreme RM reversal has never been observed before in any FRB nor in any astronomical object.

The implied short-term change of the B-field configuration in or around the FRB could be due to the vicinity of massive black holes, or a magnetized companion star in binary systems, or a young supernova remnant along the line of sight.

今回の発見から示唆されること  
将来的な発展性など



# 例: Magnetic Field Reversal around an Active Fast Radio Burst

The environment of actively repeating fast radio bursts (FRBs) has been shown to be complex and varying.

The recently localized FRB 20190520B has the best confirmed host dispersion measure, and is associated with a compact, persistent radio source (PRS).

The main tracer of the magnetic field is the rotation measure (RM), a path-integral of the line-of-sight magnetic field and electron density, which does not allow a direct measurement.

Here we report direct evidence for a rapid observed sign change and extreme variation of FRB 20190520B RM from  $\sim 10000 \text{ rad m}^{-2}$  to  $\sim -16000 \text{ rad m}^{-2}$  between 2021 and 2022.

Such extreme RM reversal is not expected for any astronomical object.

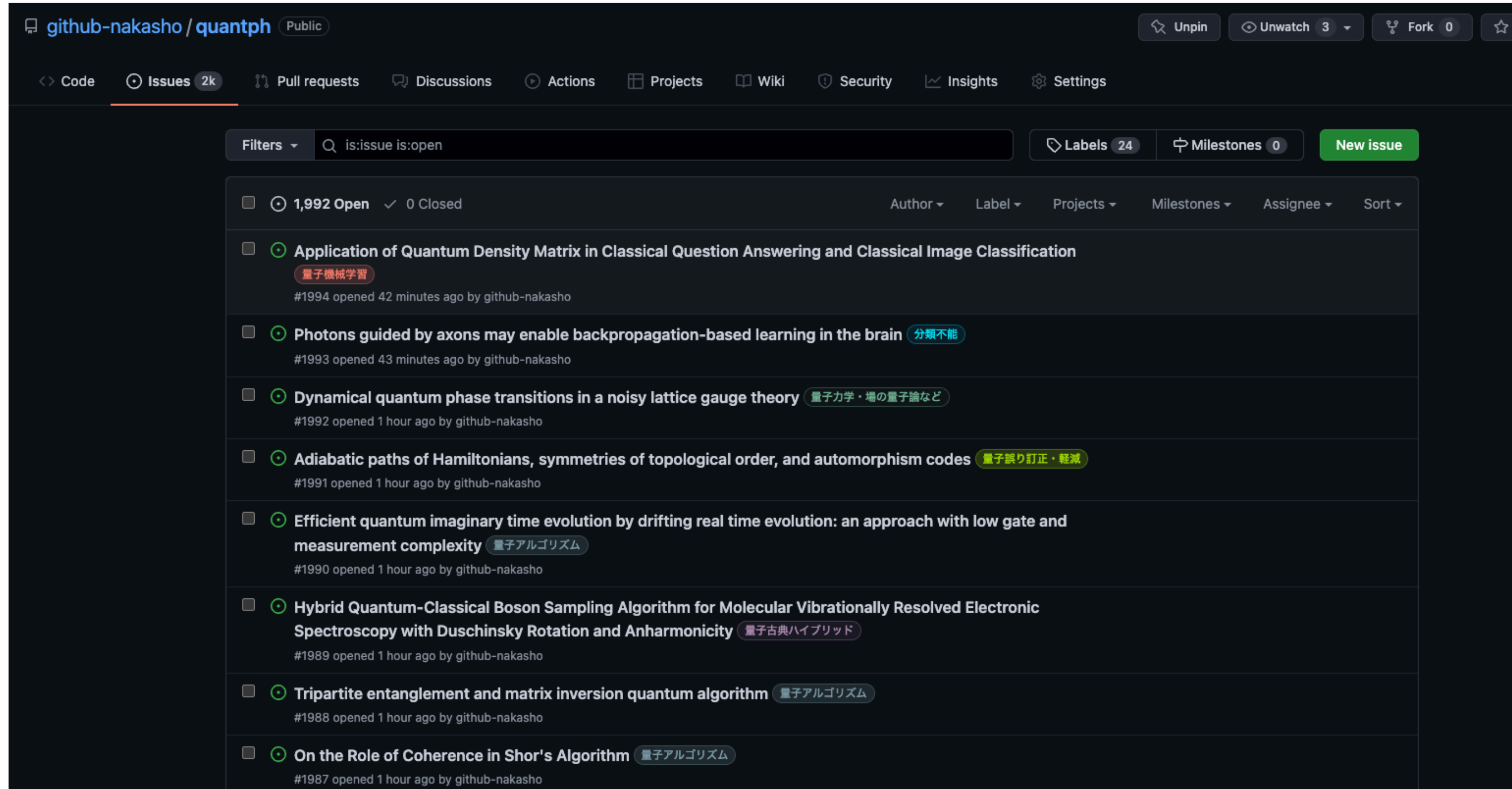
The implied short-term changes in the magnetic field in the vicinity of massive black holes, young supernova remnants, or a binary system, or a

The image shows a screenshot of a tweet in Japanese. The tweet is from a user with a profile picture of a character. The text of the tweet reads: "#キャルちゃんのastrophチェック FRB 20190520BにおいてRM(Rotation Measure)を観測。2021年6月から2022年1月の間に10000rad/m^2から-16000rad/m^2に大きく変化していることを発見。FRB周辺での短期的な磁場の方向変化は大質量BHや連星系伴星などが視線方向にあるため? https://arxiv.org/abs/2203.08151". Below the text is a link to an arXiv preprint. The arXiv preprint title is "Magnetic Field Reversal around an Active Fast Ra..." and the abstract snippet is "The environment of actively repeating fast radio bursts (FRBs) has been shown to be complex an...". The tweet interface includes a "全員" (Everyone) filter, a "全員が返信できます" (Everyone can reply) button, and a "ツイートする" (Tweet) button.

論文を読んだ後は...

# GitHubのリポジトリにissue登録

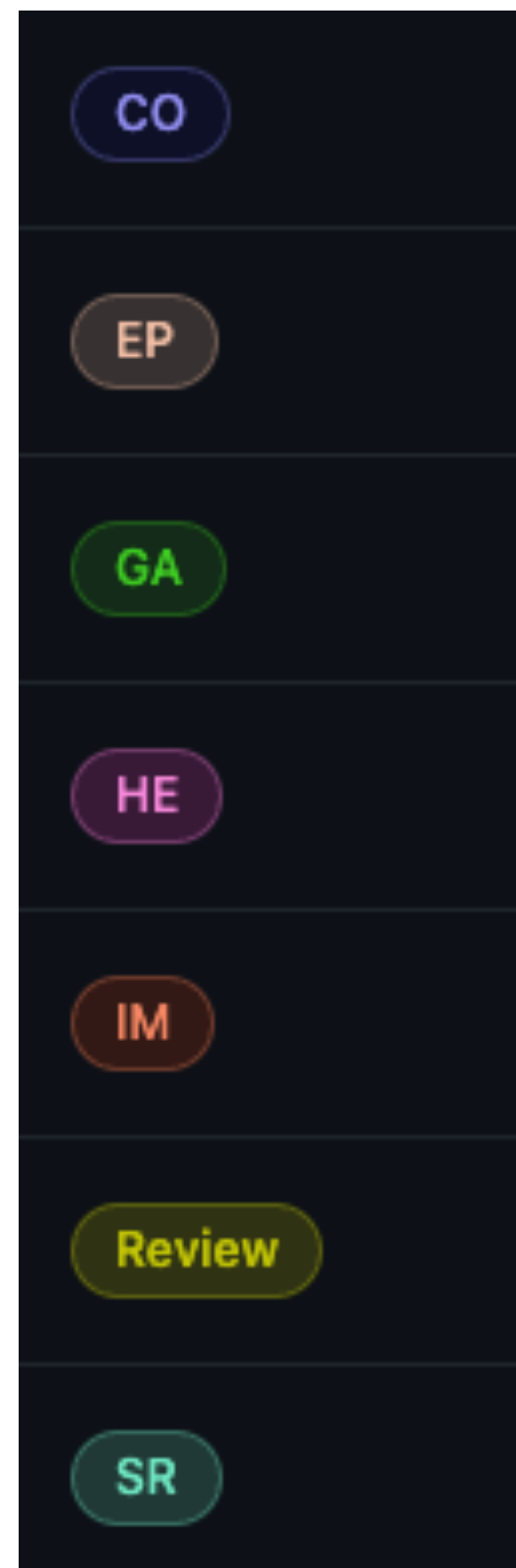
- Issueタイトルに読んだ論文のタイトルをそのままコピペ、内容部分に要約などをコピペするだけ。



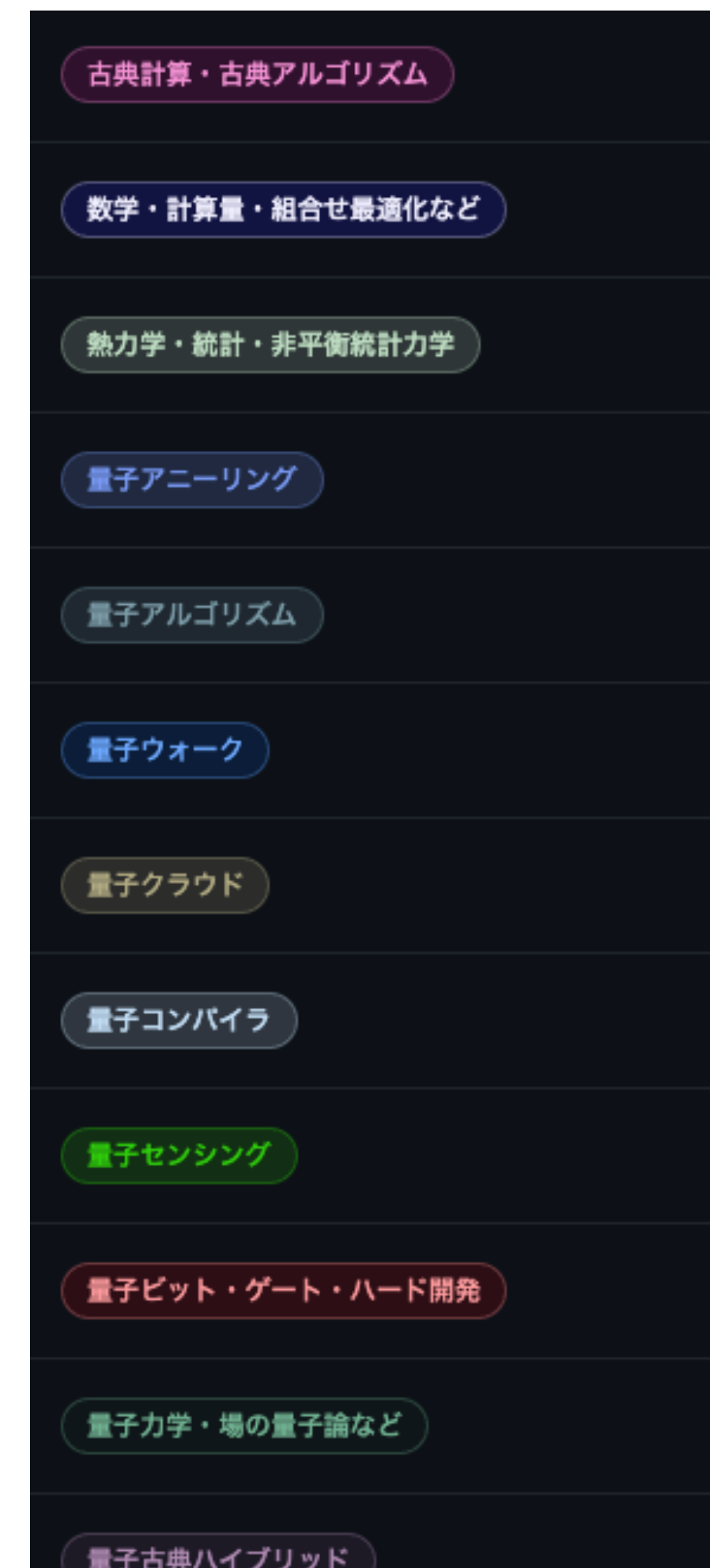
# GitHubのリポジトリにissue登録

- ラベルをつけて「どのような論文か」を大別することができる

宇宙物理



量子情報



# 結言

# 結言

- 論文チェックは、その分野の良い勉強になる
- 英語が読めない -> 和訳や理解を助けるツールをバンバン使おう
- まずは一つ、興味があるものから読んでみると良いかも
- GitHubなどでどんな論文を読んだか管理すると、あとで見返すのがラク

躊躇なくご質問ください！

より細かいことや  
みんなの前で聞きづらいことなら  
お気軽にDMよ！