Zhe Feng

2010020129@hhu.edu.cn ◇ https://ph3n92h3.github.io

Education

Hohai University Sept. 2020 - Present
B.Sc in Physics *GPA: 4.86/5.00, ranking 1/57*

- Mechanics: 92, Thermal Physics: 95, Electromagnetism: 94, Fundamental Optics: 91
- Method of Mathematical Physics: 99
- Theoretical Mechanics: 93
- Electrodynamics: 97
- Thermodynamics and Statistical Mechanics: 97
- Quantum Mechanics: 99, Advanced Quantum Mechanics: 93
- Solid-state Physics: 94

Research Interest

Primary Interest (Trained)

- **General Relativity and Quantum Cosmology** cosmological inflation, cosmological perturbation, modified gravity, black hole, compact star

Other Interest

- **General Relativity and Quantum Cosmology** thermal history of the early universe, dark matter, etc.
- **High Energy Physics - Theory** string theory, supersymmetric field theor, scattering amplitude, quantum field theory in curved space

Research Experience

General Relativity and Quantum Cosmology Feb. 2022 - Present

Modified Gravity and Astrophysics

Z. Feng, *Charged anisotropic white dwarfs in $f(R,T)$ gravity*, arxiv:2210.01574[gr-qc]

- In the context of $f(R,T) = R + 2\beta T$ gravity, where R is the Ricci scalar and T is the trace of the energy-momentum tensor, the equilibrium structure of charged anisotropic white dwarfs (WDs) is studied. The stellar equations for the general case are derived and numerical solutions are found for the Chandrasekhar equation of state (EoS) and a charge density distribution proportional to the energy density $\rho_{ch} = \alpha\rho$. By adjusting different parameters, the properties of the solutions under various conditions are compared. Most importantly, by going beyond the trivial WD in GR in various ways, the solutions may exhibit super-Chandrasekhar behavior. This paper is a study of a WD structure, and the results obtained may have a contrasting effect on astronomical observations such as superluminous type Ia supernovae.

Modified Gravity and Cosmology

Z. Feng, *Slow-roll inflation in $f\left(R,T,R_{ab}T^{ab}\right)$ gravity*, arxiv:2211.13233[gr-qc]

- In the framework of $f\left(R,T,R_{ab}T^{ab}\right)$ gravity theory, the slow-roll approximation of the cosmic inflation is investigated, where T is the trace of the energy-momentum tensor T^{ab}, R and R_{ab} are the Ricci scalar and tensor, respectively. After obtaining the equations of motion of the gravitational field from the action principle in the spatially flat FLRW metric, the fundamental equations of this theory are received by introducing the inflation scalar field as the matter and taking into account only the minimum curvature-inflation coupling term. Remarkably, after taking the slow-roll approximation, the identical equations as in $f(R,T)$ gravity with a RT mixing term are derived. Several potentials of interest in different domains are evaluated individually, calculating the slow-roll parameter and the e-folding

number N. Finally, we analyze the behavior of the inflation scalar field under perturbation while ignoring the effect of metric perturbations. This research complements the slow-roll inflation in the modified theory of gravity.

Condensed Matter - Materials Science Sept. 2021 - Present

Miniaturized Wavelength-Resolvable Photodetector Based on Fabry-Pérot Multilayer Film / Si Structure *Prof. Zhibin Shao(HHU)*

- Hohai University Innovation Training Project for Undergraduates *Excellent Completion*
- The absorption spectrum of silicon is not selective to the wavelength of light, which makes it difficult for existing photodetectors to achieve spectral resolution, which limits the application scenarios of photodetectors. The Fabry-Pérot multilayer film is expected to solve this problem due to its high flexibility and strong wavelength selection performance. By coupling the Fabry-Pérot multilayer film with silicon-based semiconductors, Wavelength selection can be performed while light detection is performed, thereby achieving wavelength resolution.
- Traditional large-scale, fixed spectrometers usually require long optical paths and wide receiving surfaces, which are difficult to meet the application requirements of timeliness, portability, and miniaturization. Photodetectors are based on electrode layers and single crystal silicon. The photoelectric characteristics are based on the intrinsic properties of semiconductors and do not depend on long optical paths and wide receiving surfaces. Applying them to spectral resolution can solve the size limitation of traditional spectrometers.

Laser Etching-Assisted Patterning of Silicon Micro-Nano Structures *Prof. Zhibin Shao(HHU)*

- Hohai University Innovation Training Project for Undergraduates *Excellent Completion*
- Laser has the characteristics of good monochromaticity, good directionality, high precision, and high designability. Compared with other preparation methods of micro-nano structure materials, laser processing has the advantages of simple equipment, high arbitrariness, and easy adjustment of parameters. Research on laser engraving The application of etching in the preparation of silicon micro-nanostructures is of great significance.
- In the production of photovoltaic cells, surface texturing technology is used to prepare silicon micro-nano structures to improve the light absorption rate and photoelectric conversion efficiency of the panel. However, this technology also makes silicon-based photovoltaic panels present a single dark color, reducing the aesthetics of photovoltaic panels. By precisely controlling the size and position of silicon micro-nano structures, local optical properties of silicon wafers can be controlled, which is expected to realize the preparation of patterned photovoltaic panels and promote the development of the decorative solar industry.

Professional Skills

Language

- CET - 6: 539

Program & Code & CS

- Mathematica(including xAct, FeynCalc, FIRE6, Rubi), Python
- GNU/Linux(use Arch Linux daily)
- LaTeX

Honors & Awards

1. Hohai University Outstanding Student Pioneer for 2021-2022 *Nov. 2022*
2. Hohai University Scholarship of Academic Excellence for 2021-2022 *Nov. 2022*
3. Hohai University Scholarship of Science and Technology Innovation for 2021-2022 *Nov. 2022*
4. Hohai University Scholarship of Spiritual Civilization for 2021-2022 *Nov. 2022*
5. Hohai University Scholarship of Academic Excellence for 2020-2021 *Nov. 2021*
6. Hohai University Scholarship of Science and Technology Innovation for 2020-2021 *Nov. 2021*

7. The 20th Higher Mathematics Competition of Jiangsu Higher Education Institution
   Second prize of undergraduate level I group A *Jun. 2023*
8. 2022 China Undergraduate Physics Experiment Competition *Second Prize* *Dec. 2022*
9. 2022 Contemporary Undergraduate Mathematical Contest in Modeling *Second Prize* *Nov. 2022*
10. The 19th Higher Mathematics Competition of Jiangsu Higher Education Institution
    First prize of undergraduate level I group A *Nov. 2022*
11. 2022 Mathematical Contest In Modeling *Honorable Mention* *2022*
12. The 13th National University Mathematics Competition (Non-Math Major) *First Prize* *Dec. 2021*
13. The 18th Higher Mathematics Competition of Jiangsu Higher Education Institution
    First prize of undergraduate level I group A *Jun. 2021*

Unimportant ones are not listed.

Volunteer Experience

- Blood donations totaled 1700 mL for six times *2020 ∼ 2023*
- Excellent volunteer in the epidemic(COVID-19) prevention, Linzhang, Handan, Hebei *2020 ∼ 2022*
- Volunteer in Jiulong Lake Reading Center, Jiangning, Nanjing, Jiangsu *2020*

Updated on June 21, 2023