

Axions in Seoul

(Seoul National University, Seoul, July 26-30, 2026)

Welcome and Opening Remarks

Kiwoon Choi

IBS CTPU-PTC

A brief history of axions

The story of axions began nearly 50 years ago with the pioneering works of Peccei and Quinn (1977), followed by Weinberg and Wilczek (1978).

Peccei and Quinn showed that the strong CP problem could be resolved by a spontaneously broken anomalous global $U(1)$ symmetry, now called the Peccei-Quinn symmetry.

Weinberg and Wilczek independently recognized that this elegant mechanism predicts a new light pseudo-Nambu–Goldstone boson, which Wilczek named **the axion**, borrowing the name from a laundry detergent because it "cleaned up" the strong CP problem.



Quanta Magazine 2017



Wikipedia



However, the original Peccei-Quinn-Weinberg-Wilczek (PQWW) axion was ruled out experimentally almost immediately:

$$m_a \sim m_\pi \frac{100 \text{ MeV}}{f_a}, \quad g_{aX} \propto \frac{1}{f_a} \quad (X = N, \gamma, \text{mesons}, \dots)$$

$$f_a(\text{PQWW}) \sim 100 \times \sin 2\beta \text{ GeV}$$

Fortunately, the axion idea survived in the form of the "invisible axion," which can be much lighter and much more weakly coupled than the original PQWW axion:

$$f_a(\text{invisible}) \gg 100 \text{ GeV}$$

- * **KSVZ:** Kim (1979); Shifman, Vainshtein, Zakharov (1980)

- * **DFSZ:** Dine, Fischler, Srednicki (1981); Zhitnitsky (1980)

New classes of invisible axions also have been introduced in the mid 80s:

- * **Extra-dimensional (or string theory) axions:** Witten (1984),

- * **Composite axions:** Kim (1985),

Soon after the theoretical proposal of the axion, its astrophysical and cosmological implications were recognized, and the possibility of experimental detection was also appreciated:

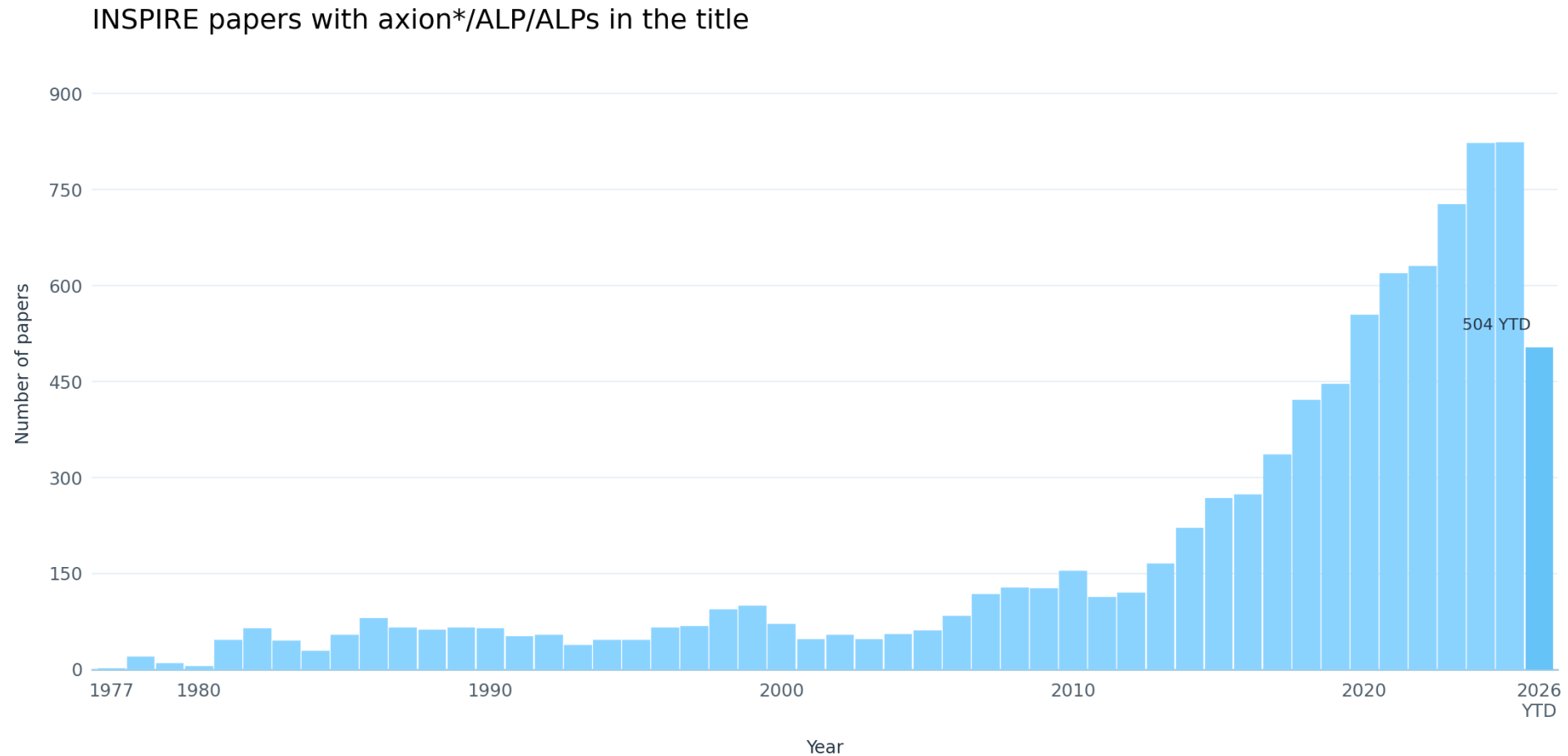
- * **Axions in stars:** Dicus, Kolb, Teplitz, Wagoner (1978),
- * **Axion dark matter:** Preskill, Wise, Wilczek (1983); Abbott, Sikivie (1983); Dine, Fischler (1983),
- * **Laboratory detection:** Sikivie (1983),

Thus, the study of axions and ALPs spans an extraordinary range of length or energy scales, extending in some sense from the largest relevant length scale (the cosmological horizon corresponding to an energy of order 10^{-32} eV) to perhaps the smallest possible length scale (the quantum gravity scale corresponding to an energy of order 10^{27} eV.)

Consequently axion physics is a truly interdisciplinary field, bringing together ideas from particle physics, astrophysics, cosmology, string theory, and atomic, molecular and optical physics.

Many of the pioneering developments in axion physics were made several decades ago.

However, in recent years, the field has experienced a remarkable resurgence of interest. This renewed excitement is precisely why we are gathered here today for a workshop dedicated to axion physics.



Scientific Program

The scientific program features **10 overview talks** and **10 topical talks**, providing a broad perspective on the current landscape of axion physics and the exciting directions in which the field is evolving.

The talks will cover a wide range of topics, from theoretical developments and model building to astrophysical and cosmological probes, as well as laboratory searches for axions and ALPs.

Overview Talks

- **Tony Gherghetta** (Minnesota Univ.)
- **Sungwoo Hong** (KAIST)
- **Hyungjin Kim** (IPhT)
- **Luca Di Luzio** (INFN, Padua)
- **Matt Reece** (Harvard Univ.)
- **Giovanni Villadoro** (ICTP, Trieste)
- **SungWoo Youn** (IBS DMAG)
- **Seokhoon Yun** (Kyungpook National Univ.)
- **Robert Ziegler** (KIT)
- **Jure Zupan** (Univ. of Cincinnati)

Topical Talks

- **Jae Hyeok Chang** (Seoul National Univ.)
- **Gongjun Choi** (Minnesota Univ.)
- **Raymond Co** (Indiana Univ.)
- **Sang Hui Im** (IBS CTPU-PTC)
- **Mario Reig Lopez** (CERN)
- **Fabrizio Rompineve** (IFAE, Barcelona)
- **Hyeonseok Seong** (HKUST)
- **Chang Sub Shin** (Chungnam National Univ.)
- **Qiaoli Yang** (Jinan Univ.)
- **Wen Yin** (Tokyo Metropolitan Univ.)

The workshop will conclude with **KimFest** on the final day (July 30), celebrating the 80th birthday of Professor Jihn E. Kim and honoring his pioneering contributions to axion physics, with invited special guests including

- **Antonio Masiero** (Univ. of Padova / INFN Padova)
- **Hans P. Nilles** (Univ. of Bonn)
- **Stuart A. Raby** (The Ohio State Univ.)
- **Yannis K. Semertzidis** (BNL / KAIST / IBS CAPP)

Announcement for participants who have completed the online registration:

Please confirm your on-line registration by signing in at the registration desk **before lunchtime today**. After signing in, you will receive lunch coupons for the workshop period (July 27–30).

All speakers will receive the same lunch coupons at the registration desk, regardless of whether they completed the online registration.

We hope you will enjoy both the workshop and your stay in Seoul, and take this opportunity to learn more about the many fascinating aspects of axion physics.

Many thanks again to

all the speakers and participants for joining us, and the members of the organizing committee for their efforts in organizing this workshop.

Organizing committee of Axions in Seoul

- Won Sang Cho (IBS CTPU-PTC)
- Kiwoon Choi (IBS CTPU-PTC)
- Eung Jin Chun (KIAS)
- Sungwoo Hong (KAIST)
- Kwang Sik Jeong (Pusan Nat'l Univ.)
- Hyung Do Kim (Seoul Nat'l Univ.)
- Sung Woo Youn (IBS DMAG)