

INAF



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ISTITUTO NAZIONALE DI ASTROFISICA
OSSERVATORIO ASTROFISICO DI TORINO

On the shoulders of giants

Cold Jupiters and their role in the formation of inner low-mass planets. From theory to observations

25-26-27 March 2026

Turin



Letter of Isaac Newton to Robert Hook (5 February 1675)

Cambridge Feb. 5. 1675.

Thanks for the offer of freest pardon contentions in print to be considered

Correspondence desired

seemes not very willing to meddle with Philosophy

If I had Hook's Letter to me as an answer I would read it more plain

At the reading of yo^r letter I was exceedingly well pleased & satisfied with yo^r generous freedom, & think you have done what becomes a true Philosophical spirit. There is nothing more to be desired in matters of Philosophy more than contention, nor any kind of contention more than one in print: & therefore I gladly embrace yo^r proposal of a private correspondence. What is done before many witnesses is seldom without some further concern than that for truth: but what passes between friends in private is usually more of name of consultation rather than contest, & so I hope it will prove between you & me. Your animadversions will be therefore very welcome to me: for though I was formerly tired with this subject, & have not yet nor I believe ever shall recover so much love for it as to delight in spending time about it; yet to have at once in short of strongest or most pertinent Objections that may be made, I could really desire, & know no man better able to furnish me with them than yo^r self. In this you will oblige me. And if there be any thing els in my papers in wch you apprehend I have assumed too much, or not done you right, if you please to reserve your sentiments of it for a private letter, I hope you will find also that I am not so much in love wth Philosophical productions but wth I can make them yield to equity & friendship. But, in yo^r meane time you defer too much to my ability for searching into this subject. What Descartes did was a good step. You have added much several ways, & especially in taking of colours of thin plates into Philosophical consideration. If I have seen further it is by standing on of the shoulders of Giants. But I make no question but you have done very considerable experiments besides those you have published, & some it's very probable the same wth some of those in my late papers. Two at least I know you have observed, of dilatation of yo^r eye, & of apparition of

Transit of a star near the Sun. But not to insist on this: yo^r Letter gives me occasion to inquire concerning an observation you were propounding to me to make here of the transit of a star near of Zenith. I came out of London some days sooner proposed by them of told you of, it falling out so that I was to meet a friend then at Hook to be in the market, & so missed of yo^r intended directions. Yet I called at yo^r lodgings observed by a day or two before I came away, but missed of you. If therefore you continue in yo^r mind to have it observed, you may by sending yo^r directions

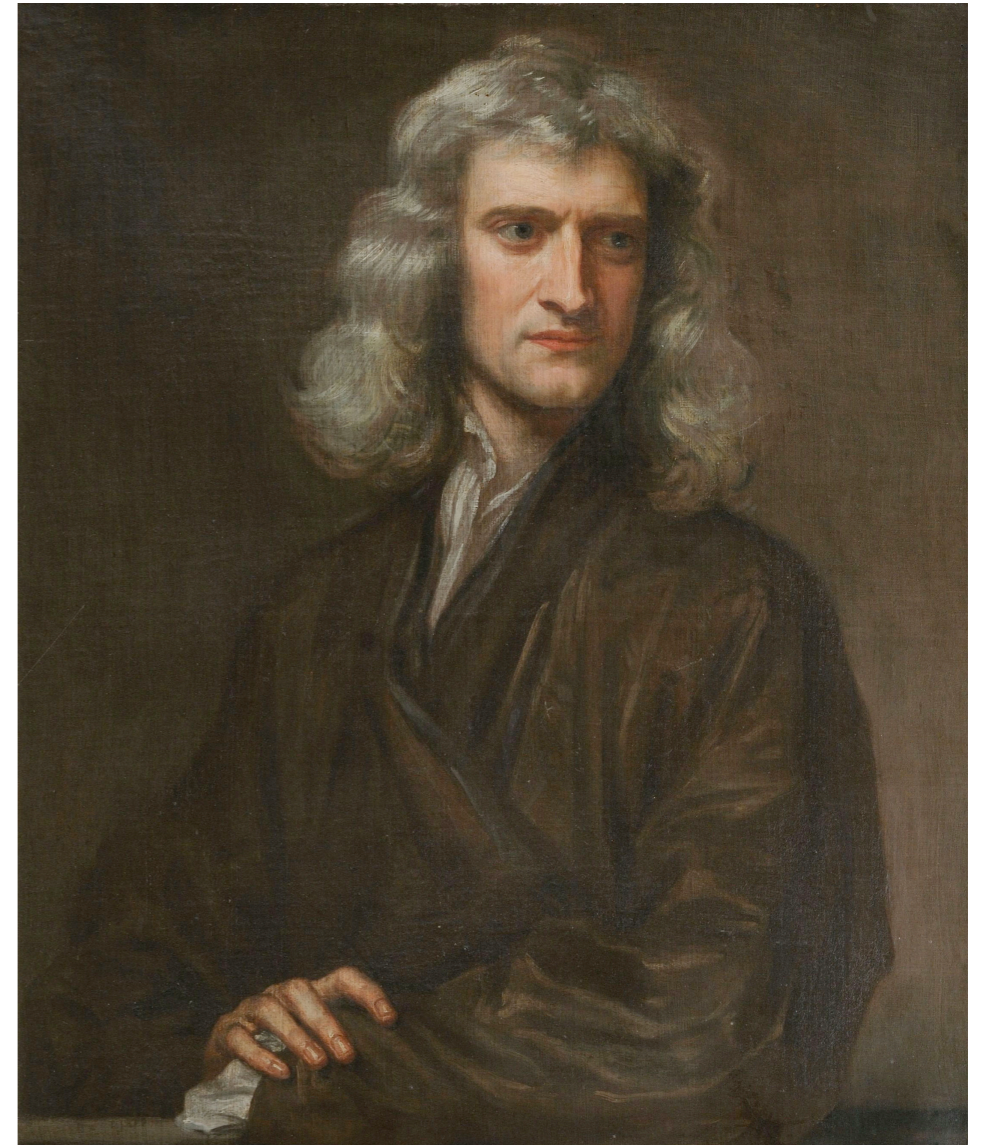
Yo^r Humble Servant
I. Newton.

On the shoulders of giants...

What Des-Cartes did was a good step. You have added much several ways, & especially in taking the colours of thin plates into philosophical consideration. If I have seen further, it is by standing on the shoulders of Giants.

Isaac Newton

letter to Robert Hook, 5 February 1675





The California Legacy Survey. III. On the Shoulders of (Some) Giants: The Relationship between Inner Small Planets and Outer Massive Planets

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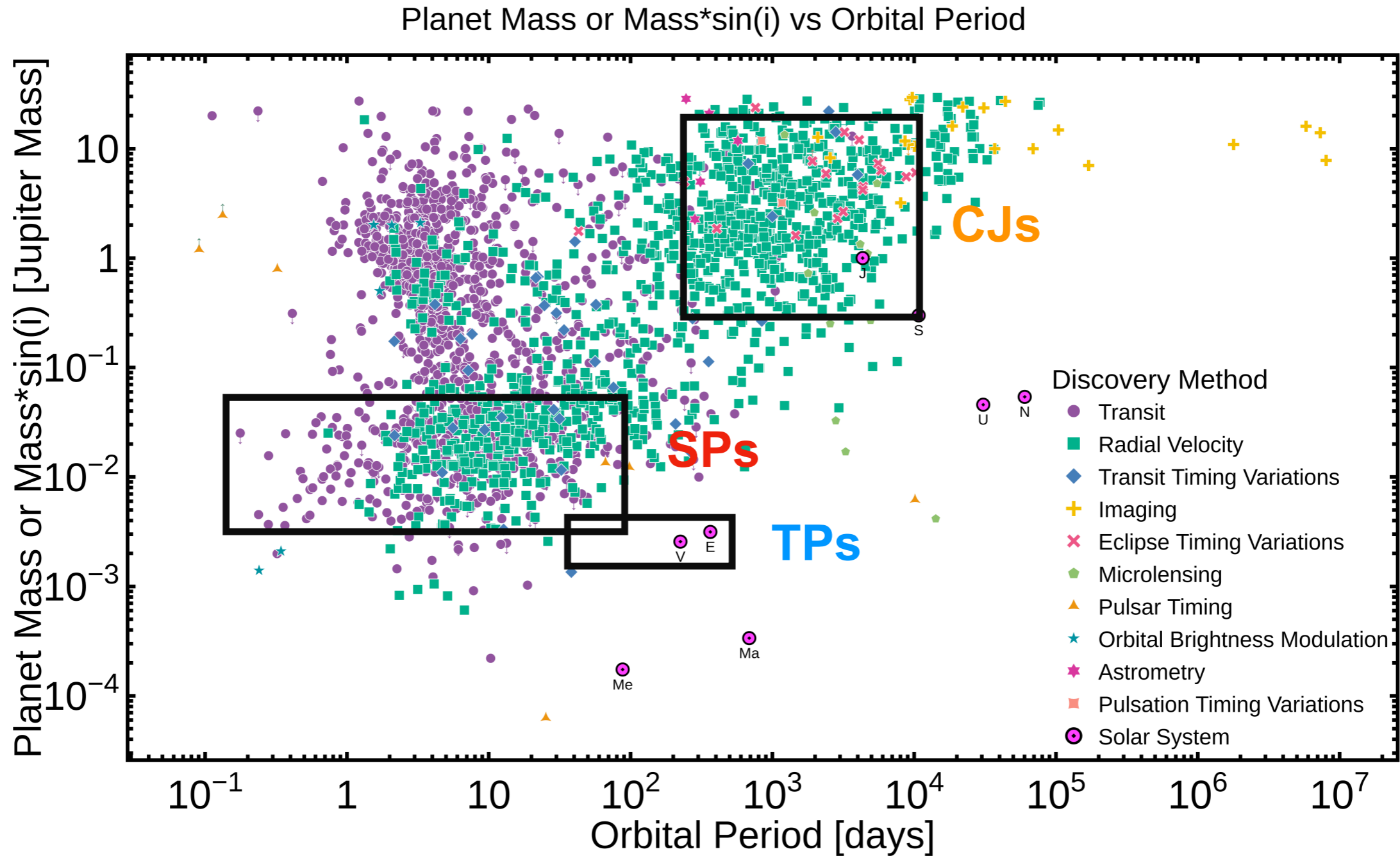
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Abstract

We use a high-precision radial velocity survey of FGKM stars to study the conditional occurrence of two classes of planets: close-in small planets (0.023–1 au, 2–30 M_{\oplus}) and distant giant planets (0.23–10 au, 30–6000 M_{\oplus}). We find that $41_{-13}^{+15}\%$ of systems with a close-in, small planet also host an outer giant, compared to $17.6_{-1.9}^{+2.4}\%$ for stars irrespective of small planet presence. This implies that small planet hosts may be enhanced in outer giant occurrences compared to all stars with 1.7σ significance. Conversely, we estimate that $42_{-13}^{+17}\%$ of cold giant hosts also host an inner small planet, compared to $27.6_{-4.8}^{+5.8}\%$ of stars irrespective of cold giant presence. We also find that more massive and close-in giant planets are not associated with small inner planets. Specifically, our sample indicates that small planets are less likely to have outer giant companions more massive than approximately $120 M_{\oplus}$ and within 0.3–3 au, than to have less massive or more distant giant companions, with $\sim 2.2\sigma$ confidence. This implies that massive gas giants within 0.3–3 au may suppress inner small planet formation. Additionally, we compare the host-star metallicity distributions for systems with only small planets and those with both small planets and cold giants. In agreement with previous studies, we find that stars in our survey that only host small planets have a metallicity distribution that is consistent with the broader solar-metallicity-median sample, while stars that host both small planets and gas giants are distinctly metal rich with $\sim 2.3\sigma$ confidence.

Unified Astronomy Thesaurus concepts: [Exoplanets \(498\)](#)

Cold Jupiters (CJs), close-in small planets (SPs), and terrestrial planets (TPs)



- **Cold Jupiters (CJs) [Jupiter and Saturn analogs]:**
 $a = 1\text{-}10$ AU and $M_p = 0.3\text{-}13 M_{\text{Jup}}$ (or $0.3\text{-}20, 0.5\text{-}20, 0.1\text{-}13 M_{\text{Jup}}$)
- **Close-in small (low-mass) planets [SPs, i.e. super-Earths and sub-Neptunes]:**
 $a \lesssim 0.4$ AU (or $\lesssim 1$ AU) from $P < 100$ d (or < 400 d) and $1 < R_p < 4 R_{\oplus}$ | $1 < M_p < 20 M_{\oplus}$ ($1 < M_p < 30 M_{\oplus}$)
- **Terrestrial planets (TPs):** systems with at least one planet with $R_p \sim R_{\oplus}$ & $M_p \sim M_{\oplus}$ in the habitable zone

Crucial questions about cold Jupiters and their role in the formation of inner small (low-mass) planets

- ▶ What role do CJs play in the formation of SPs (super-Earths and sub-Neptunes) in inner orbits?
- ▶ Do CJs promote (friends) or inhibit (foes) the formation of inner SPs? In what cases? Or do CJs have a substantially negligible impact on it (indifferent)?
- ▶ Can the absence of SPs in the Solar System be attributed to the presence of Jupiter and Saturn?
- ▶ How does the presence of CJs influence the architectures of the inner systems?

Can we (try to) answer those questions? How?

Ground-based high-precision radial-velocity monitoring
+ space-based Gaia astrometry + imaging (?)

Inside-out approach

Search for CJs in SP systems

Outside-in approach

Search for SPs in CJ systems

Crucial questions about cold Jupiters and their role in the formation of potentially habitable terrestrial planets

- ▶ What is the role of CJs in the formation of TPs ?
- ▶ Does the emergence of life on a TP depend on the presence of a Jupiter analog (e.g., protection from impacts with potentially life-destroying asteroids and/or short-period comets)?
- ▶ What is the occurrence of Solar-System like architectures (with at least one TP in the habitable zone + one non-eccentric CJ)?

Are CJs and SPs friends? What observations tell us...

Yes: excess of CJs in SP systems (Bryan+2019; Zhu & Wu 2018; Liu+2026)

Maybe: possible excess of CJs in SP systems (Rosenthal+2022; Van Zandt+2025)

No: no excess of CJs in SP systems (Barbato+2018; Bonomo+2023; Ruggieri+, subm.)

Yes, in some cases, depending on stellar parameters (Bryan & Lee, 2024, 2025; Bonomo+2025) or planetary parameters (Lefèvre-Forján & Mulders, 2025)

Are CJs and SPs friends, foes, or indifferent?

What theory tells us...

- **Anticorrelation**: CJs as dynamical barriers to sub-Neptune inward migration (e.g., Izidoro+2015) or hindrance to SP formation inside the water snowline (Lambrechts+2019)
- **Weak or no correlation** from planetesimal (Schleckler+2021) or pebble (Danti+2025) accretion
- **Strong correlation** for low efficient gas contraction rate (Bitsch & Izidoro 2023) or planetesimal snowplow-like process due to CJ-induced secular resonances (Best+2024, 2025).

Are CJs and SPs friends, foes, or indifferent?

What a mess...

Should we be worried?

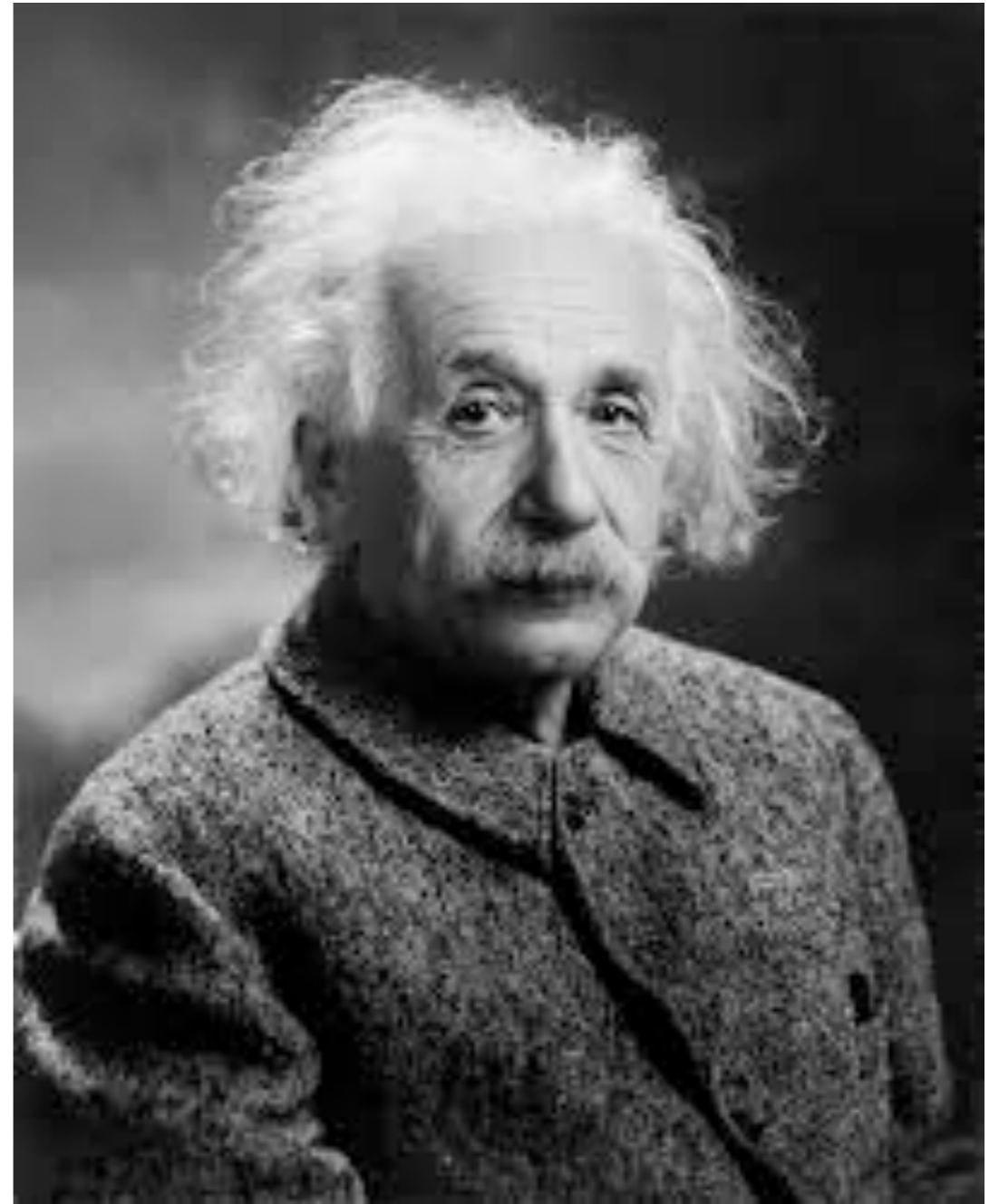
What impels us to devise theories after theories? Why do we devise theories at all? The answer is simple: because we enjoy "comprehending".

[...]

Without the passion for comprehension, there would be neither mathematics nor natural science.

Albert Einstein

On the Generalized Theory of Gravitation,
Scientific American, 1950



Technical notices (wifi)

Wifi Name: ASTOWIFI

Wifi Pwd: Benvenuto

Important Note: the wifi is not very fast, so please use it mainly to check your emails.

Technical notices (presentations)

- If you are one of the speakers, please remember to include the time for questions in your talk (3 minutes for 15 and 20 min talks, and 5 minutes for 25 and 30 min talks), and send your presentation to giantshoulders.oato@inaf.it in pdf (preferable) or pptx format by 2 p.m. CET the day before your talk.

- If you agree to the recording of your talk, please send an email to giantshoulders.oato@inaf.it with the statement

"I hereby agree to the recording of my talk and its upload to the conference website, where it will be freely accessible."

Technical notices (coffee breaks and lunches)

- Four restrooms
- **Coffee breaks** will be held on the second floor
- **Lunches** are not covered by the registration fee. There are many restaurants, snack bars, and cafeterias in the area for various price ranges (check out some suggestions on the workshop website)

On the shoulders of giants

25–27 Mar 2026
Archivio di Stato - Torino, Italy
Europe/Rome timezone

[Overview](#)[Timetable](#)[Contribution List](#)[Book of Abstracts](#)[Registration and Fee Payment](#)[Registered Participants](#)[Important dates](#)[Social Program](#)[Accommodations](#)[Venue](#)[Where to Eat](#)

Where to Eat



Since the venue is located in the centre of Turin, you will have a wide choice of restaurants, snack bars and cafeterias with various price ranges. Based on proximity and reviews, we recommend several places for lunch:

Traditional Turin cuisine

Caffè Roberto (~3m walk away)
Via Po, 5, 10124 Torino TO

Le Vitel Etonné (~5m walk away)
Via S. Francesco da Paola, 4, 10123 Torino TO

Locanda da Betty (~6m walk away)
V. Giambattista Bogino, 17, 10123 Torino TO

Ristorante Consorzio (~8m walk away)
Via Monte di Pietà, 23, 10122 Torino TO

Piola da Cianci (~10m walk away)
Largo IV Marzo, 9/b, 10122 Torino TO

Other Italian and European restaurants

FELICE A TESTACCIO (~7m walk away)
Via Pietro Micca, 17, 10121 Torino TO

[Contact](#)

 giantsshoulders.oato@in...

Technical notices (social program)

- **Welcome cocktail** later at 6 p.m. on the second floor
- **Social dinner** tomorrow at 8 p.m. at the restaurant "La via del sale" with traditional cuisine from the Piedmont and Liguria regions (we will give you more details tomorrow)
- **Tour of the Egyptian museum**, the largest Egyptian museum in the world outside Egypt, with an insight into the link between the Egyptians and astronomy, on Friday at 4 p.m. or 4:30 p.m, depending on the group you have been assigned to.

Overview

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Social Program



Welcome Cocktail

A welcome cocktail will be held on Wednesday, March 25th, at the conference venue ([Piazzetta Carlo Mollino, 1](#)) at 6 pm.

Social Dinner

The social dinner will be held on Thursday, March 26th, at the restaurant "[La Via del Sale](#)" ([Via San Francesco da Paola, 2](#)) in the center of Turin.

Cultural Event

A special cultural event will be offered to all participants on Friday, March 27th, from 4:00 pm to 6:00 pm. The activity will feature a guided visit to the [Egyptian Museum](#) ([Via Accademia delle Scienze 6](#)), one of Turin's most iconic landmark, with a focus on its fascinating links to astronomy.

Visit Turin

In addition to our conference social events, we encourage you to explore the city. Find more ideas for sightseeing and activities on the official Italian tourism website: [Turin Unmissable sites](#).

Technical notices (the LOC)



Ilaria Carleo



Mario Damasso



Gloria Guilluy



Luigi Mancini



Luca Naponiello



Matteo Pinamonti



Alessandro Ruggieri