

Gravitatie – een alledaags fenomeen dat betoverend blijft

Einstein's unknown theory of relativity revealed

He helped son to finish his maths homework

By Robert Uhlir, Technology Correspondent

ALBERT Einstein's personal letters, to be auctioned by Christie's in New York next month, reveal that at the time the scientific world was digesting his General Theory of Relativity, his son, Hans Albert, was struggling to come to terms with maths homework set by his father.

The letters show that the man who revolutionised physics in 1915 was schooling 15-year-old Hans Albert in the rather simpler disciplines of plane geometry.

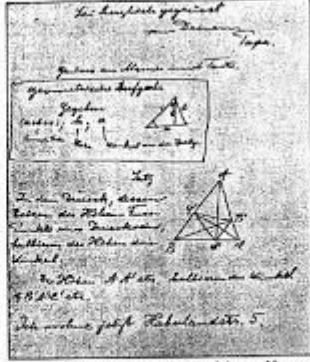
They throw a new light on previous claims that the greatest scientific mind of the 20th century was a heartless genius who treated his sons disdainfully.

"I am glad you like geometry. It was my favourite subject when I was a little older than you, perhaps about 12, but I had no use to show me anything. So I had to learn it from books," Einstein wrote, in response to a letter from Hans Albert, who later became a scientist himself.

"It would take great pleasure in instructing you but that isn't possible. If you would write me occasionally what you have learned, then I would give you a nice prob-



Albert Einstein: lessons in geometry



Letter with censor's postscript solving problem



Love letters sent to first wife Mileva Marić

or cult figure – even after his death.

"He has become the Elvis Presley of the scientific world and it would be a good thing if the archive stayed intact," said Felix de Manes Oves, international director of Christie's book department.

letter within the collection that contains mathematical exercises appears to reply to a letter from Hans Albert intercepted by censors.

"... the loquacious part of your letter was a postscript, which was not from you but from the censor. He gave the solution to my exercise, omitted by you, absolutely

full of tenderness and kisses." The letters refer to the birth of Einstein and Mileva's first child, a daughter called Lieserl, born before their marriage.

"The story problem that still needs to be resolved is how to keep our Lieserl with us. I wouldn't want to have to give her up," Einstein

The Royal Swedish Academy of Sciences has decided to award the

2017 NOBEL PRIZE IN PHYSICS

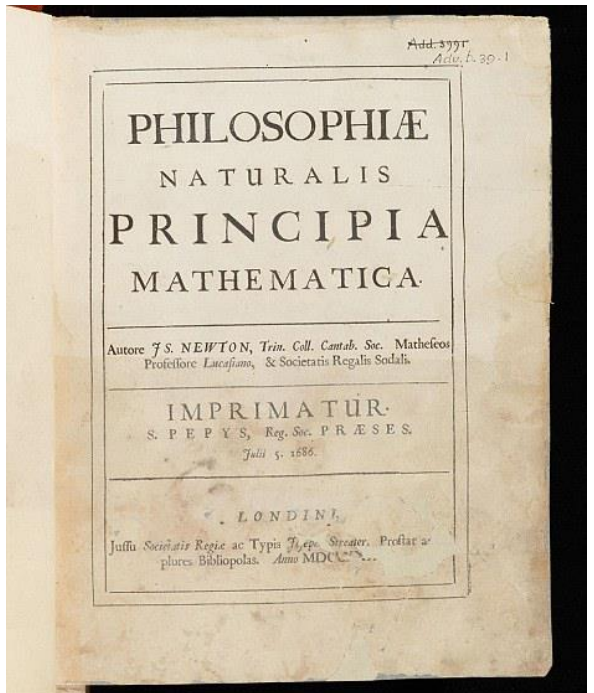


Illustrations: Miklas Elmehed, Nobel Prize Medal: © R. The Nobel

LIGHTS ALL ASKEW IN THE HEAVENS

Men of Science More or Less Agog Over Results of Eclipse Observations.

EINSTEIN THEORY TRIUMPHS



Inhoud

- Wat is de algemene relativiteits theorie?
- Wat zijn zwartekrachtsgolven?
- Hoe kun je ze meten?
- Wat is er gemeeten? Virgo's eerste detektie :)

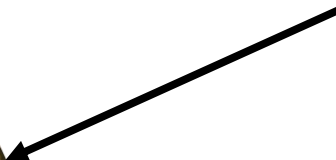
Inertiaalstelsel

een coördinatenstelsel waarin voorwerpen, waar geen kracht op werkt, stilstaan of een eenparig rechtlijnige beweging maken

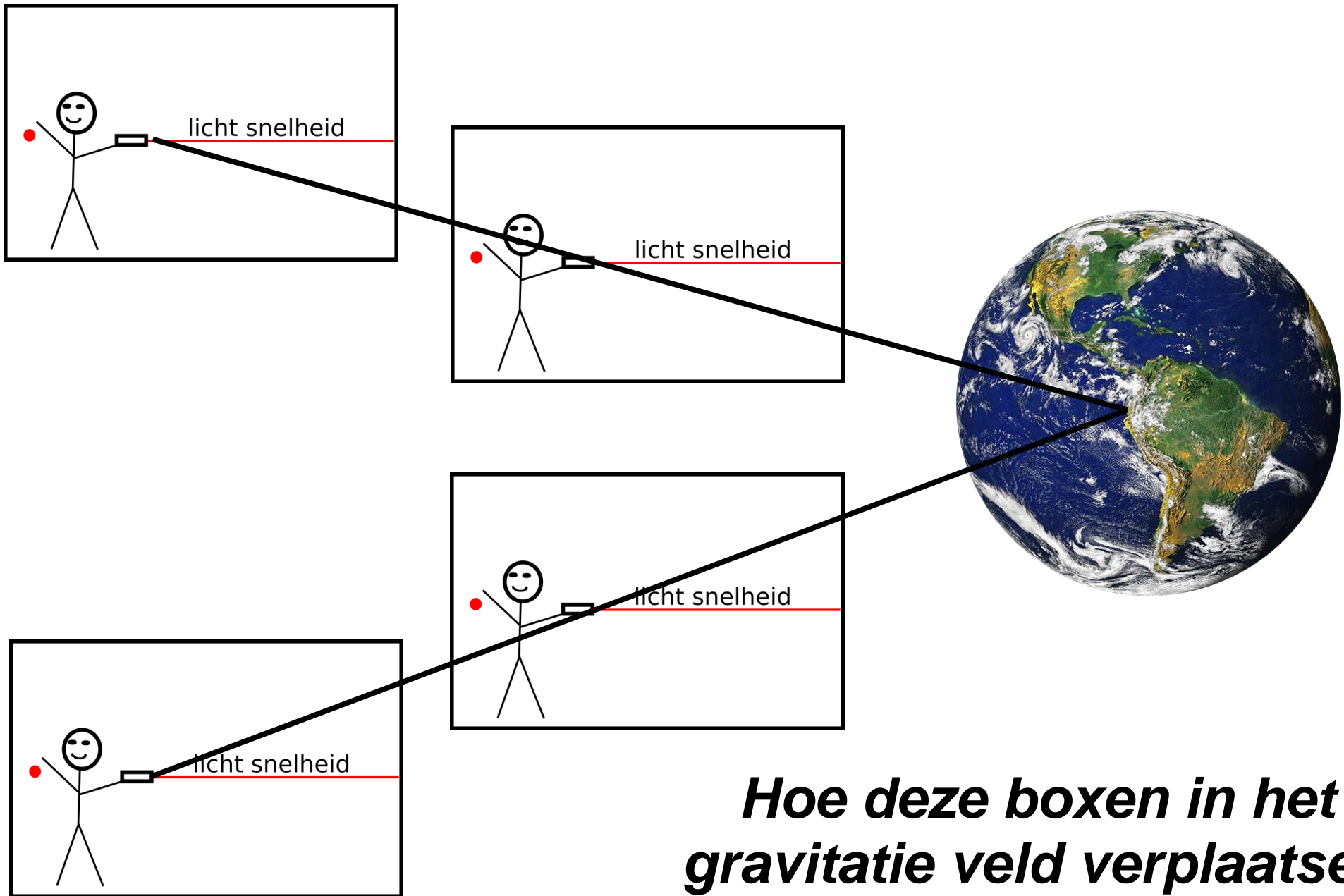


Inertiaalstelsel

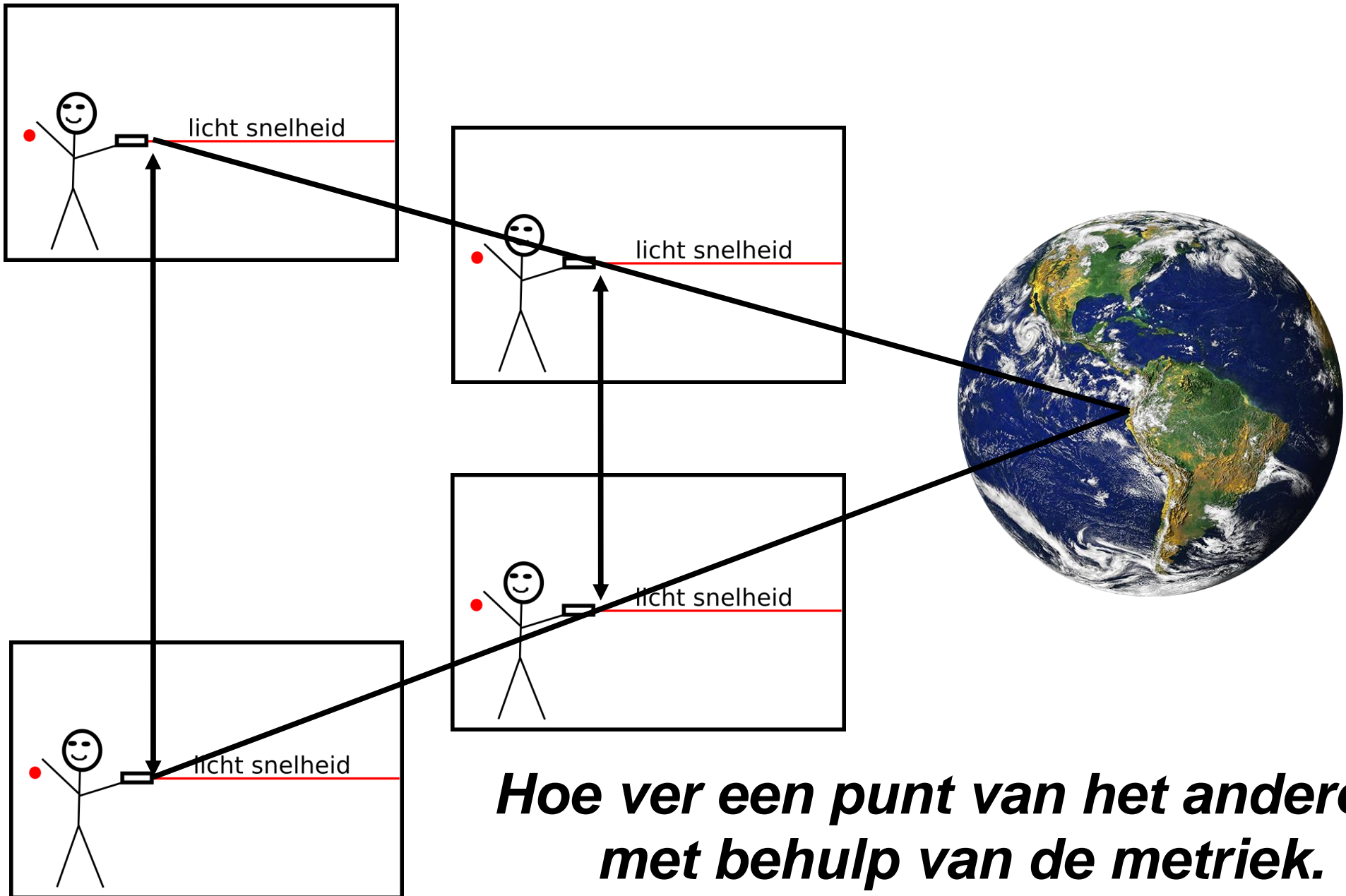
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Wat beschrijft de algemene relativiteits theorie?



Wat beschrijft de algemene relativiteits theorie?



Twee vergelijkingen

(sorry ... ze zijn wel erg mooi!)

Wat is de metriek voor een een energie verdeling?

$$R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = 8\pi GT_{\mu\nu}$$

(Einstein vergelijking)

Hoe beweegt een box wanneer ik de metriek ken?

$$\frac{d^2 x^\mu}{d\lambda^2} + \Gamma_{\rho\sigma}^\mu \frac{d^2 x^\rho}{d\lambda} \frac{d^2 x^\sigma}{d\lambda} = 0$$

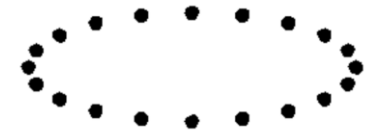
(geodesic equation)

$$R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = 8\pi GT_{\mu\nu}$$

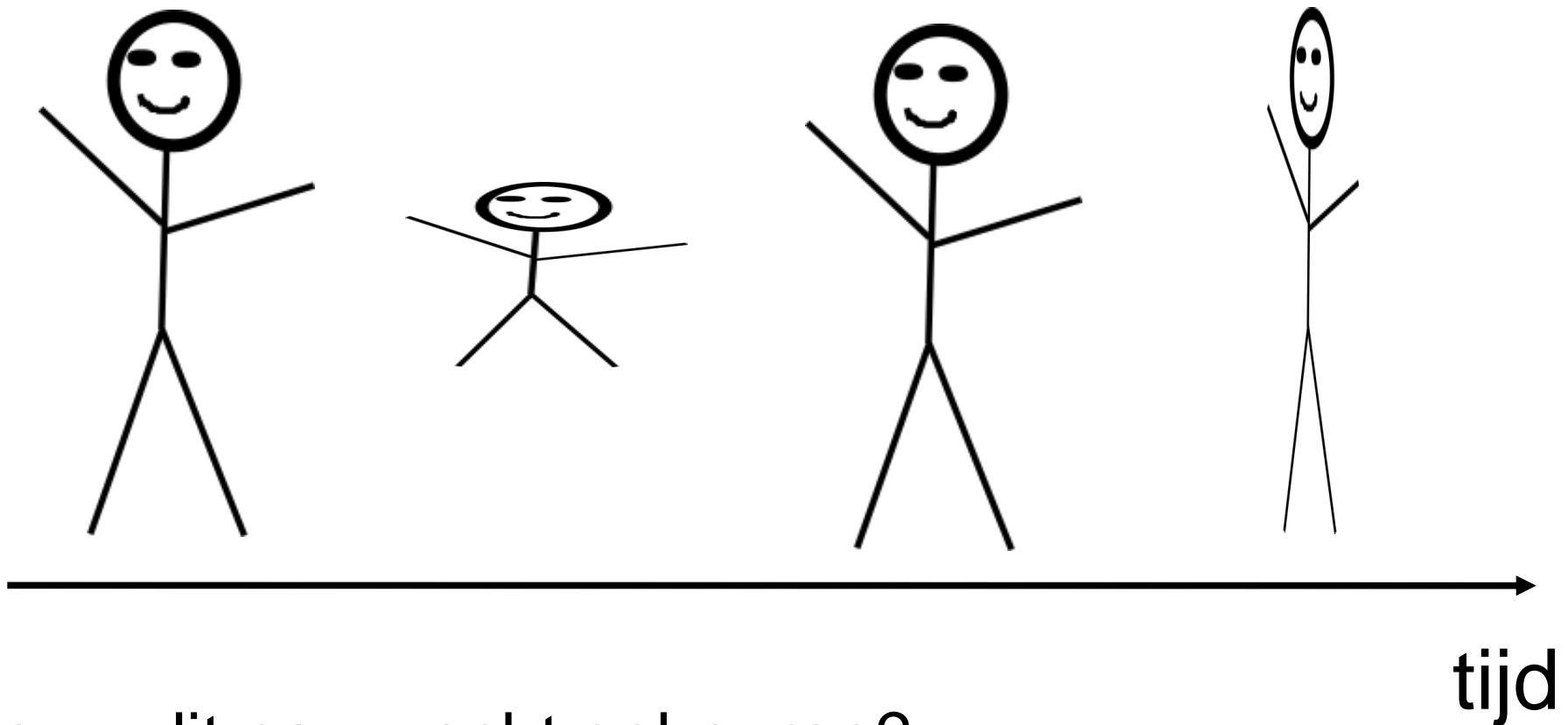
GRAVITATIONAL WAVES



Wat gebeurt wanneer een gravitatie golf voorbei komt?

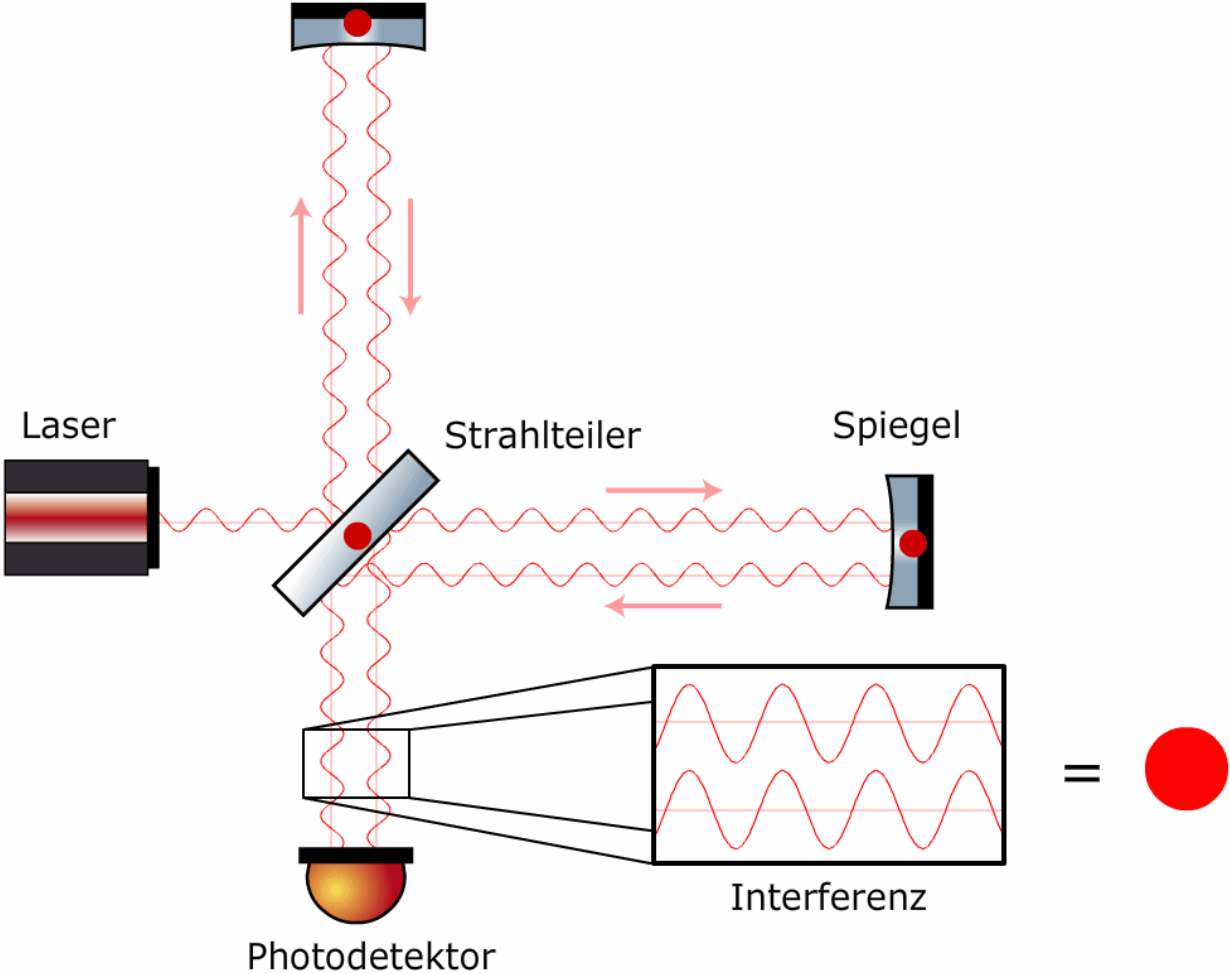


Vrij vliegend mens in het heelal:

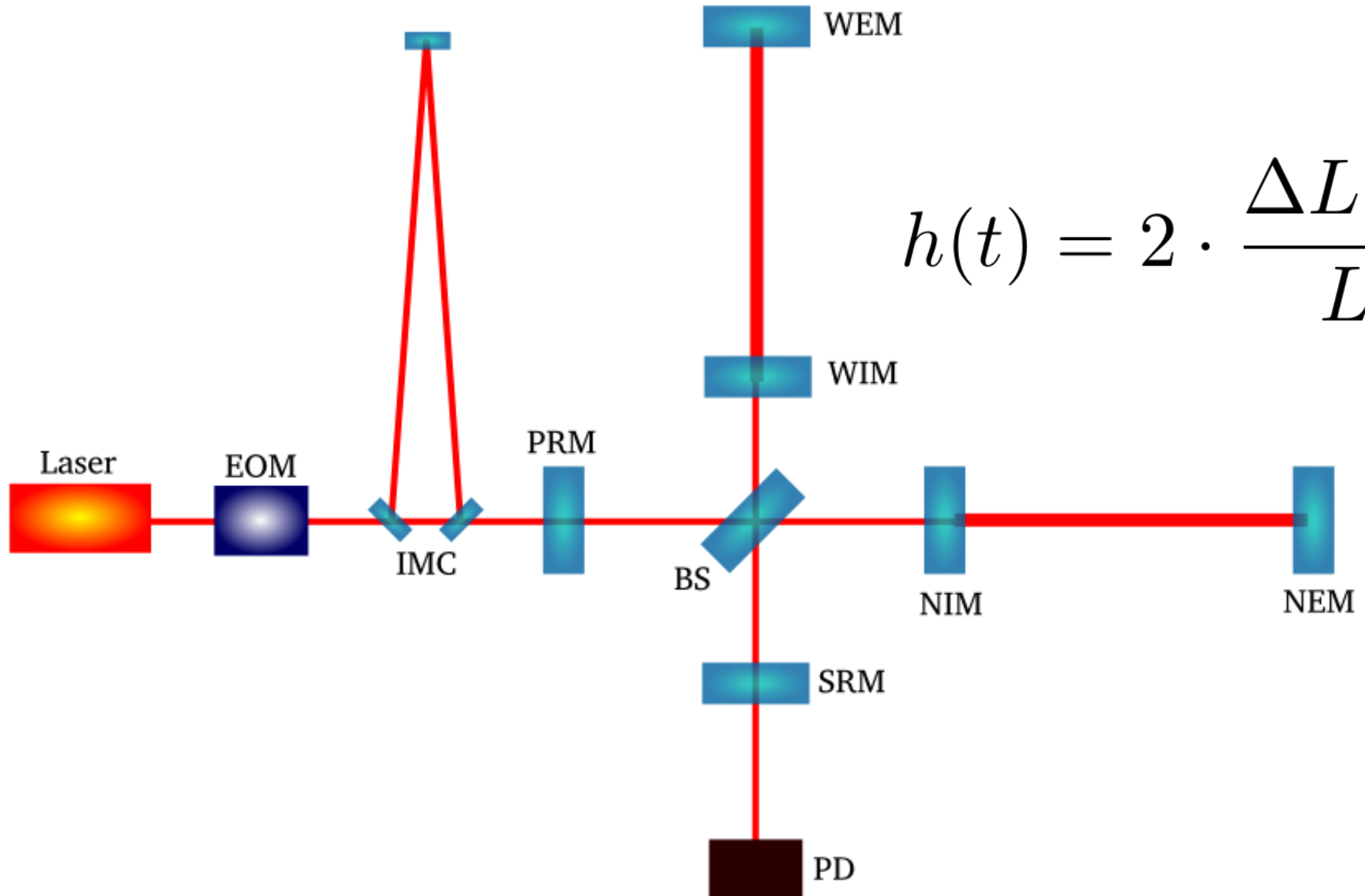


Zouw dit nouw echt gebeuren?

Interferometers – handig voor de detektie van gravitatie golven

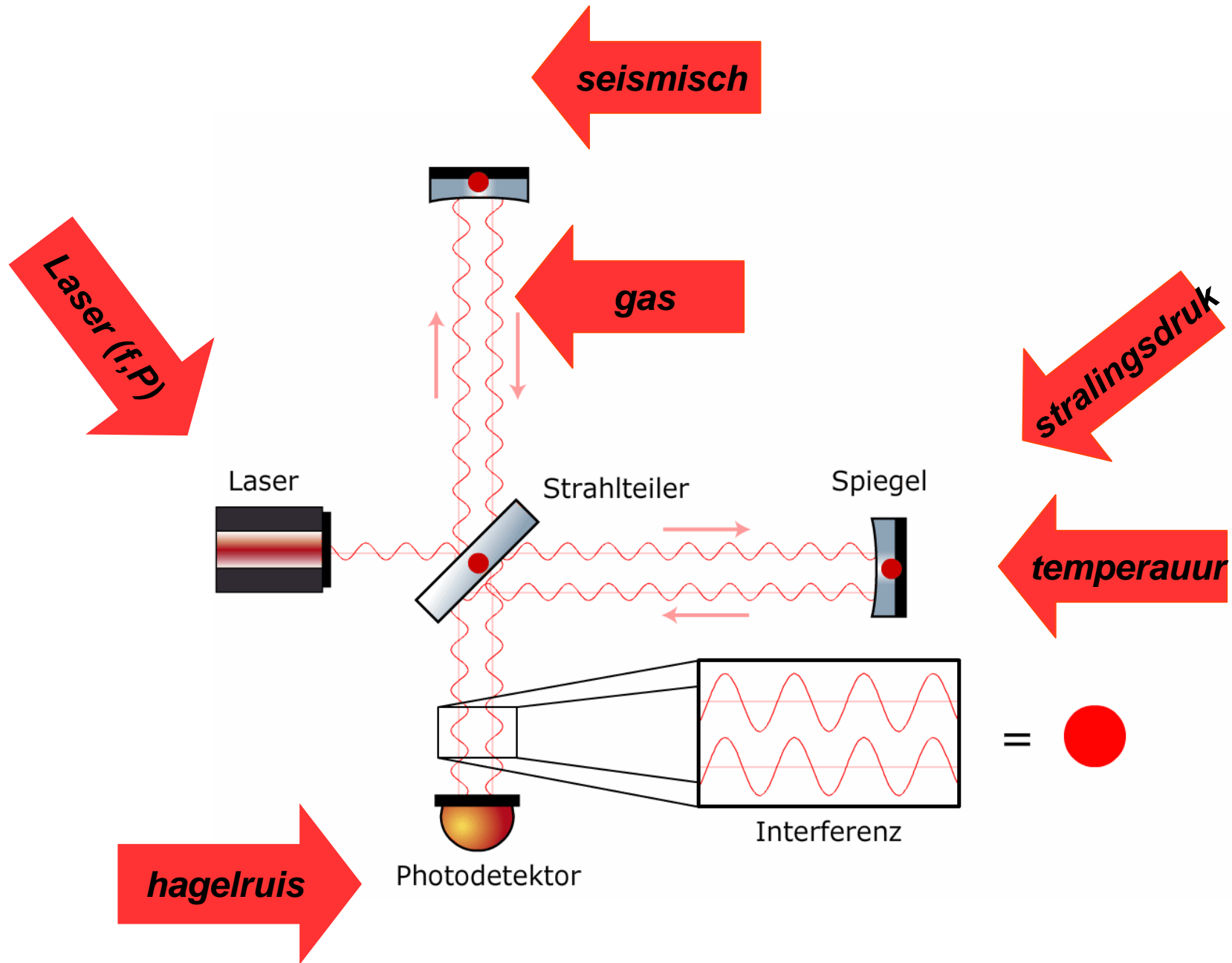


Interferometers voor de zoektocht naar gravitatie golven

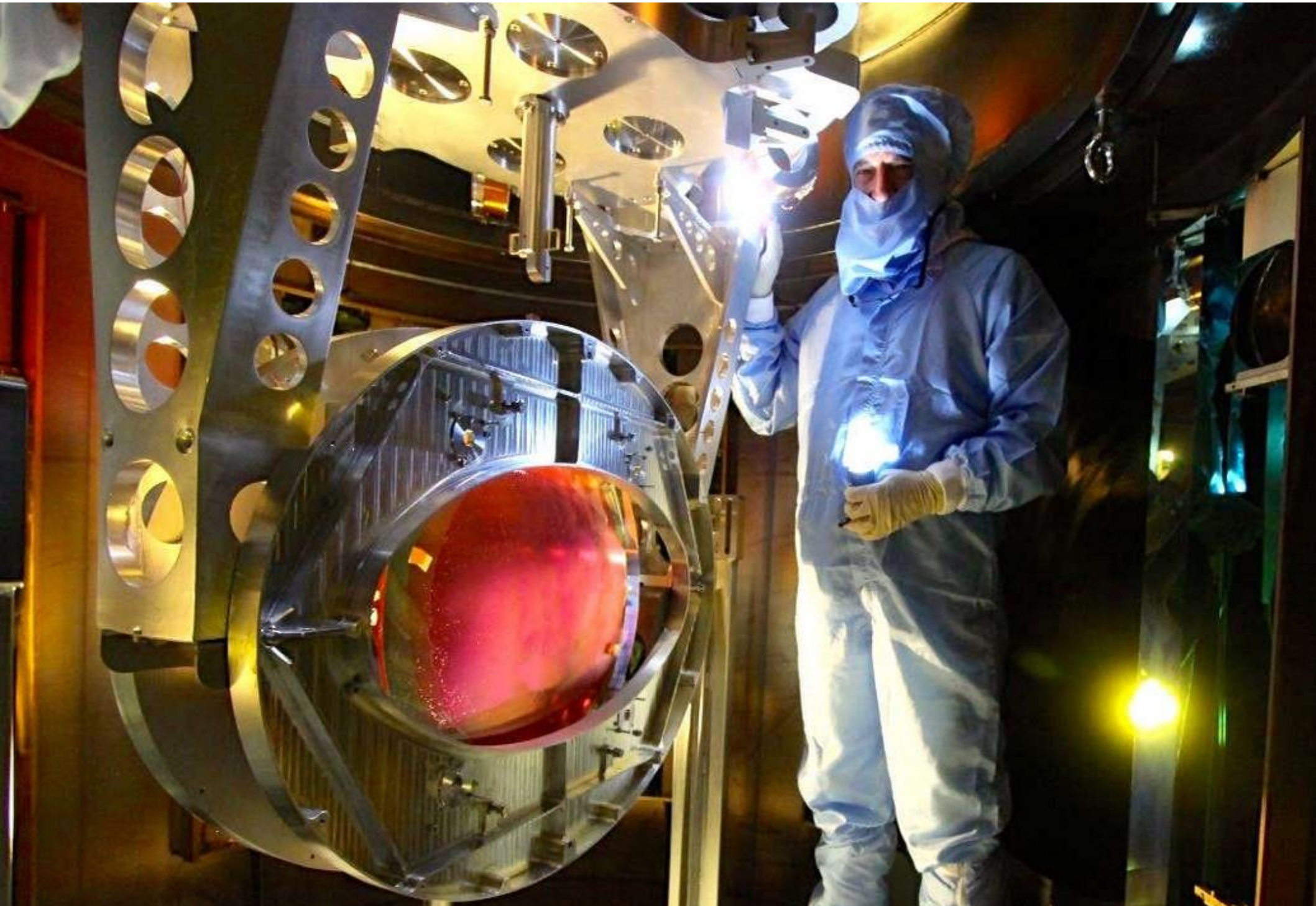


$$h(t) = 2 \cdot \frac{\Delta L(t)}{L}$$

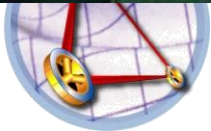
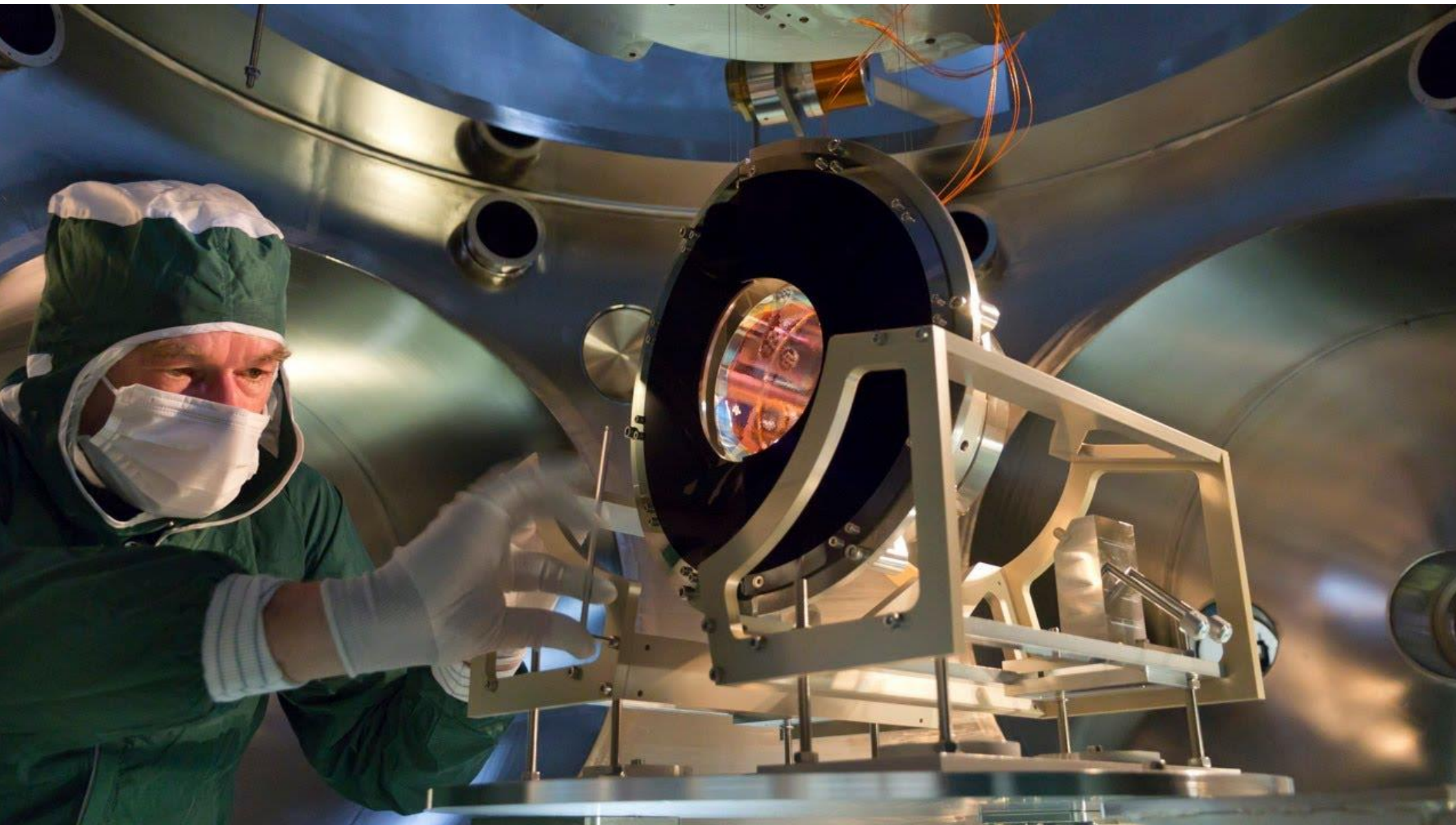
Wat is de achtergrond?



Beam splitter



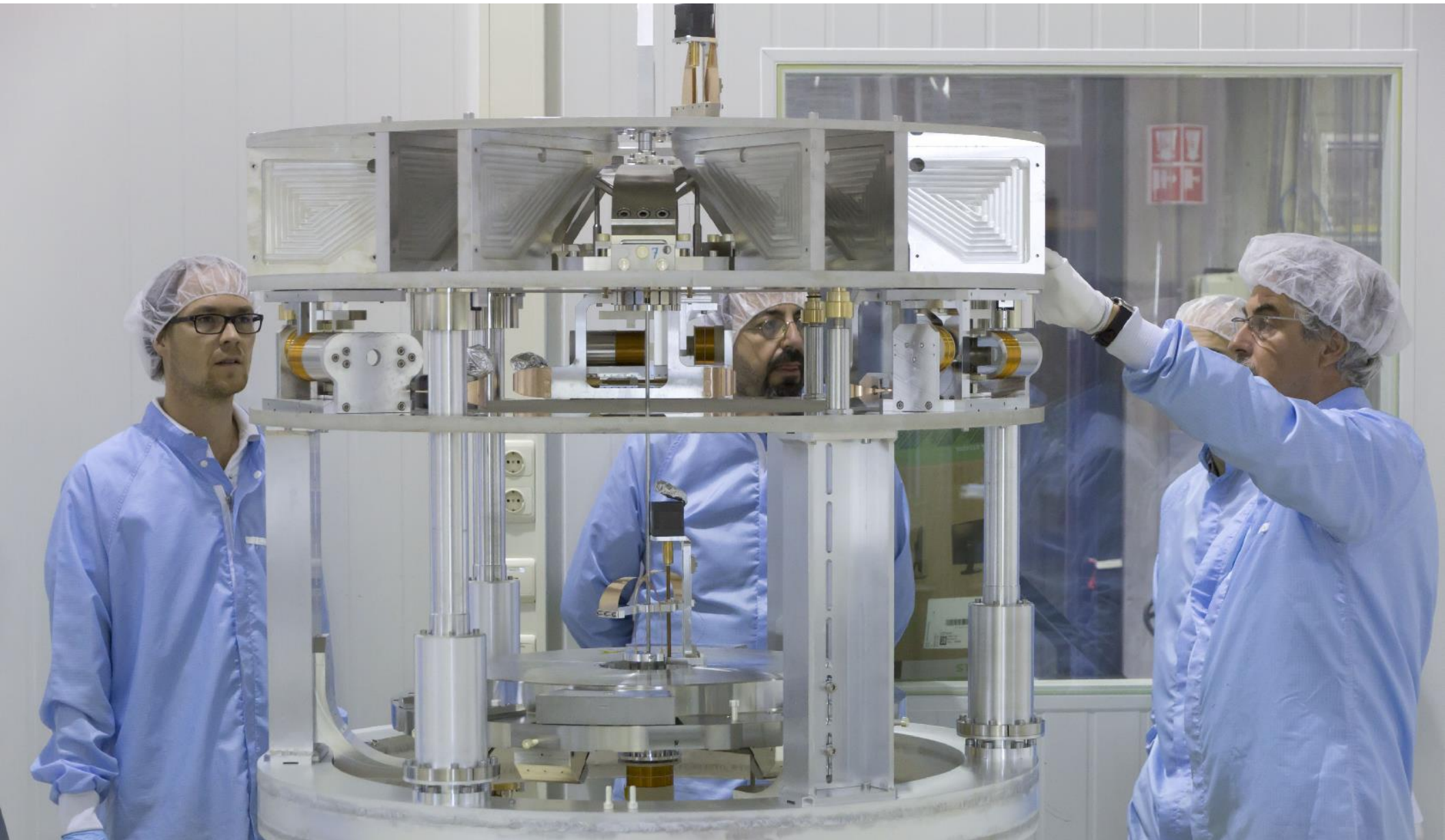
Input-mode cleaner end mirror



Seismische isolatie op de Virgo site



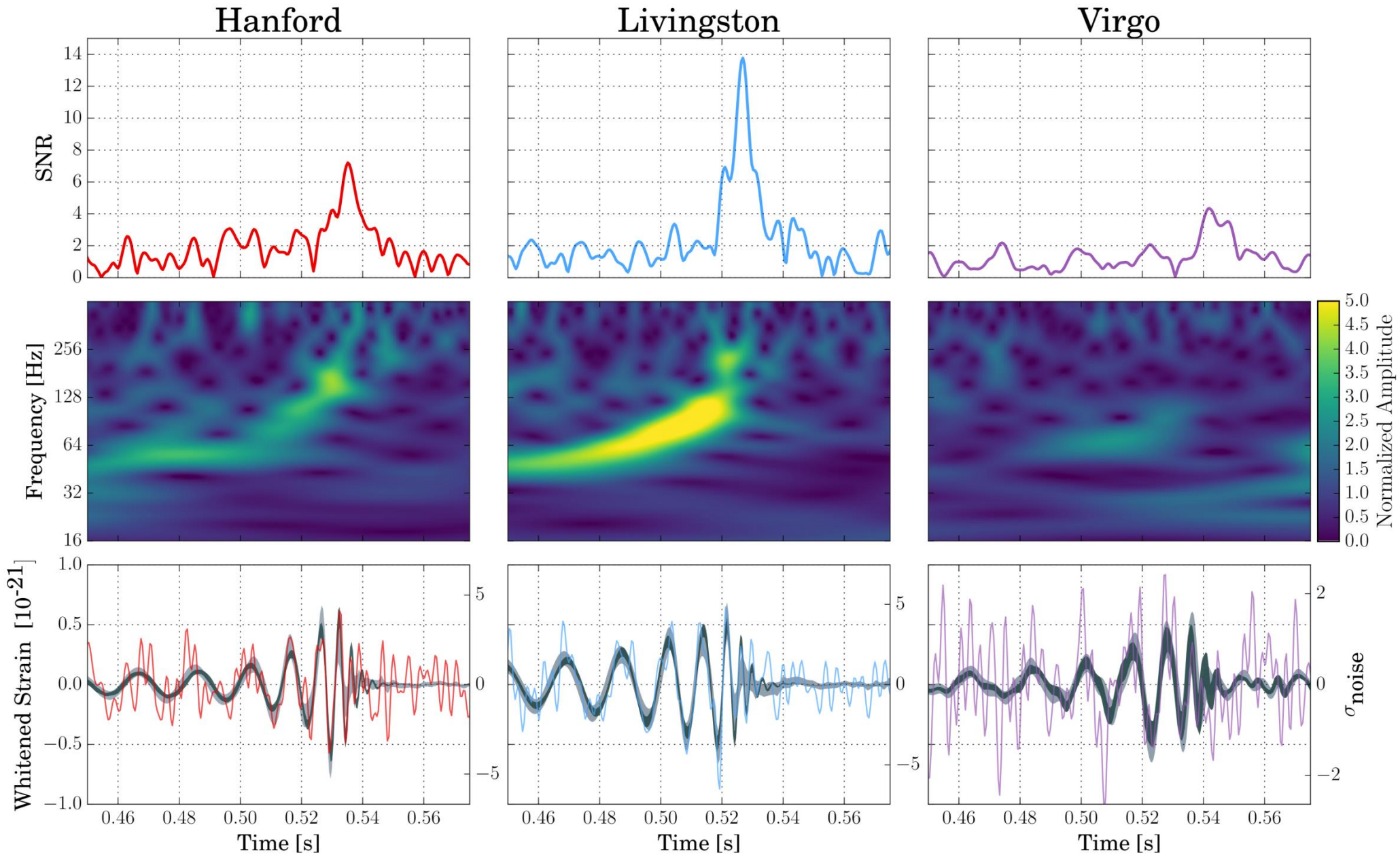
Seismische isolatie – op het Nikhef



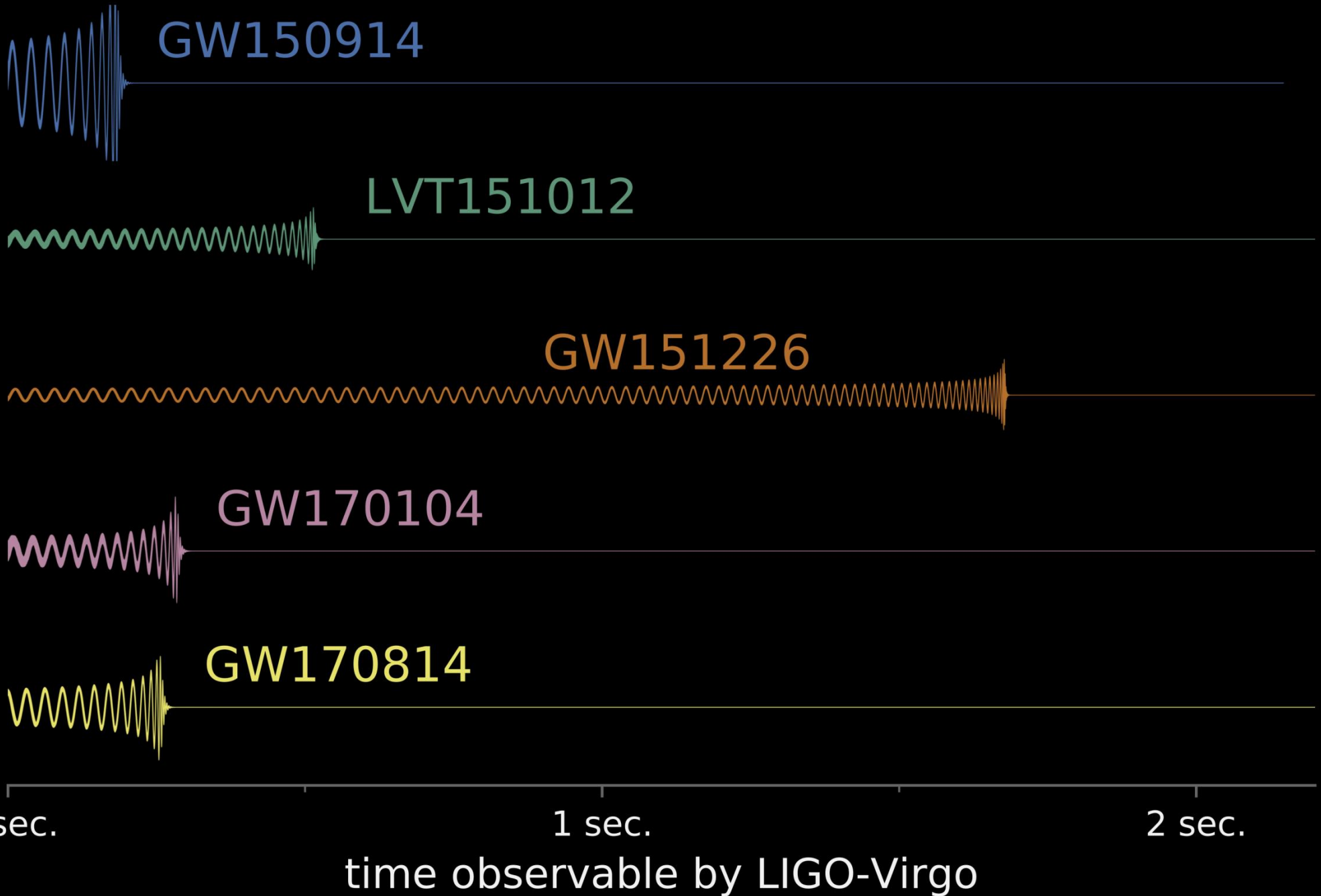
Aan het werk in het optisch lab



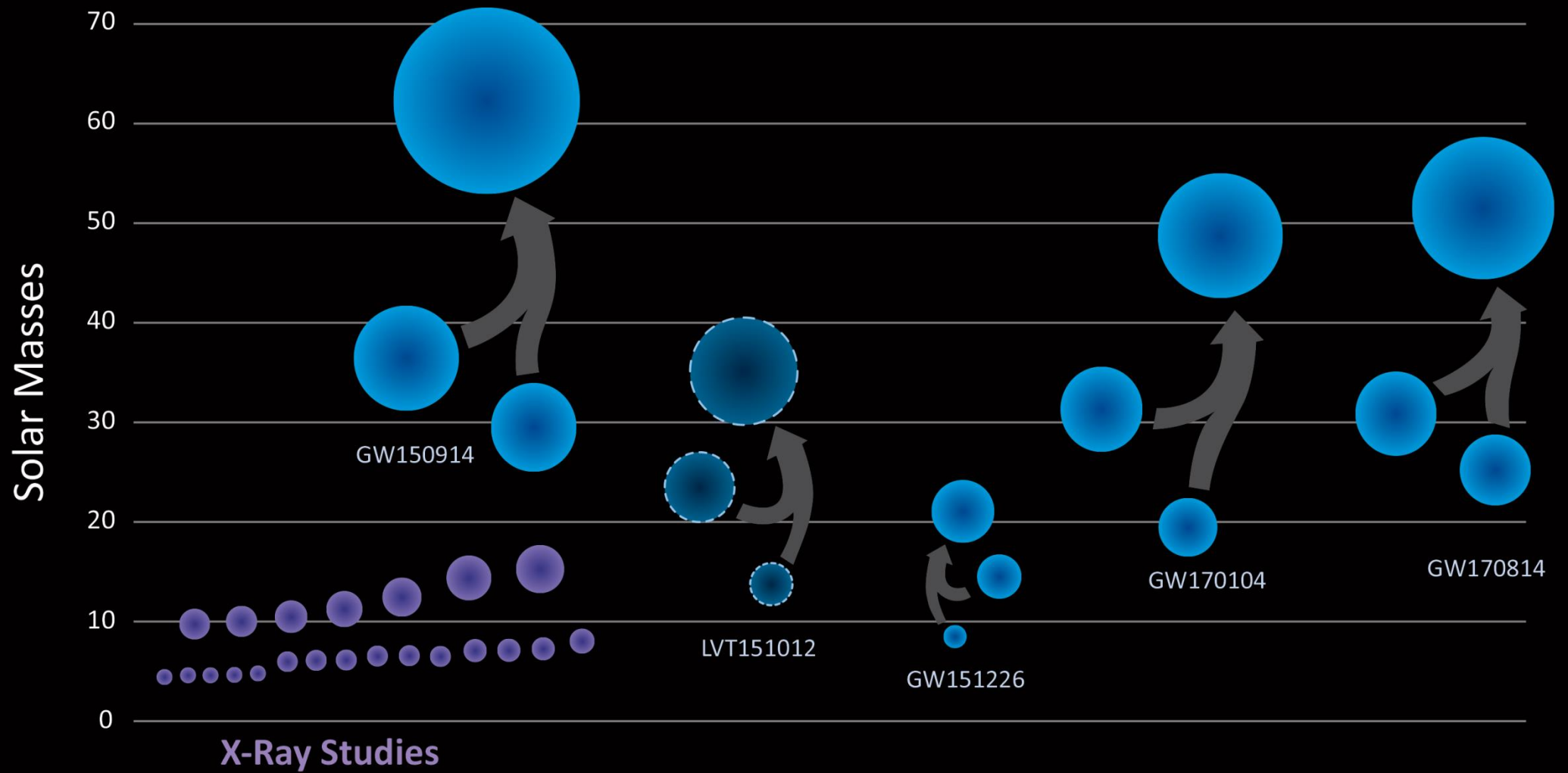
Virgo's eerste detektie net gepubliceerd



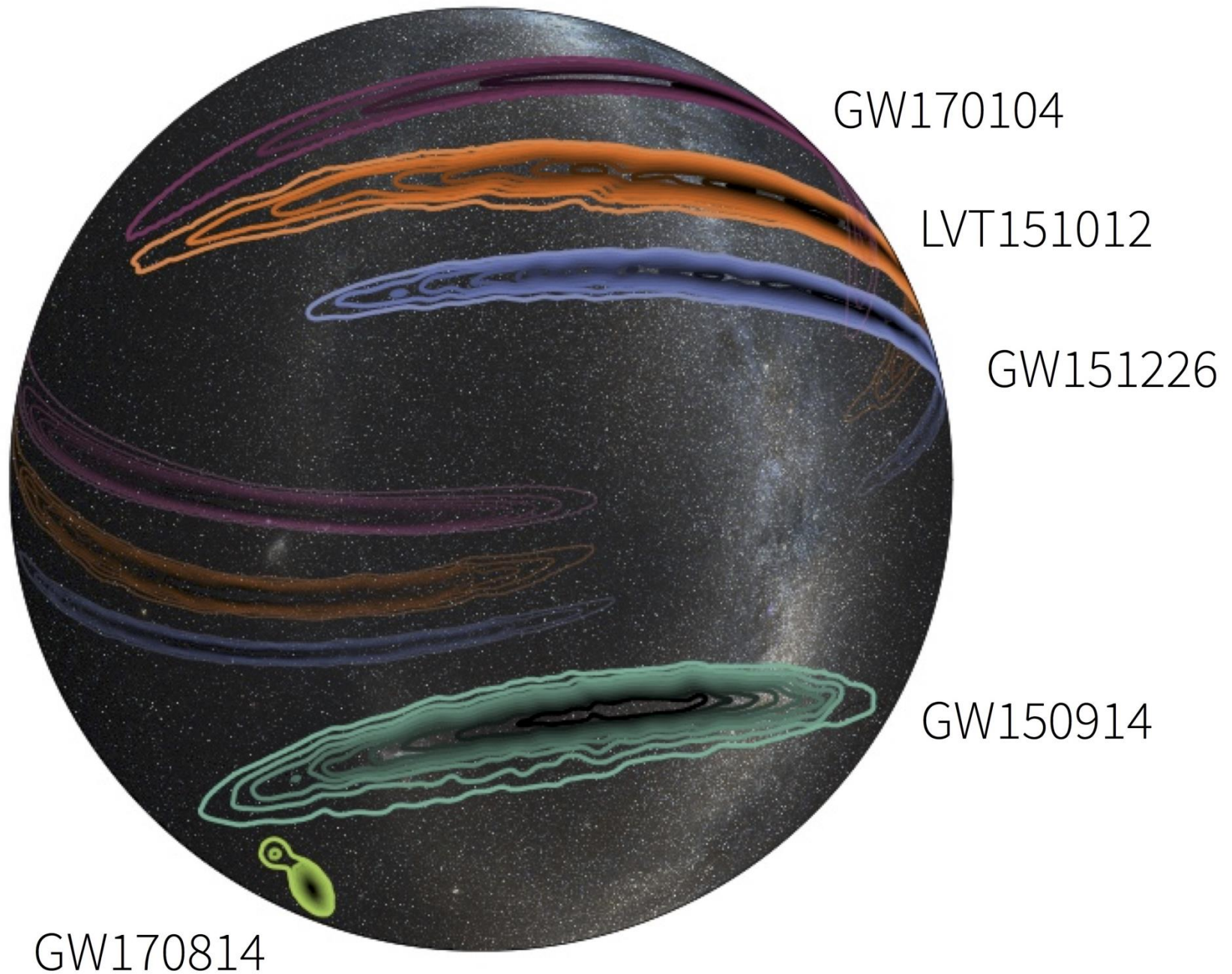
Detekties voor zo ver



Nieuwe populatie zwarte gaten



Virgo's contributie voor localizatie





Stay tuned

