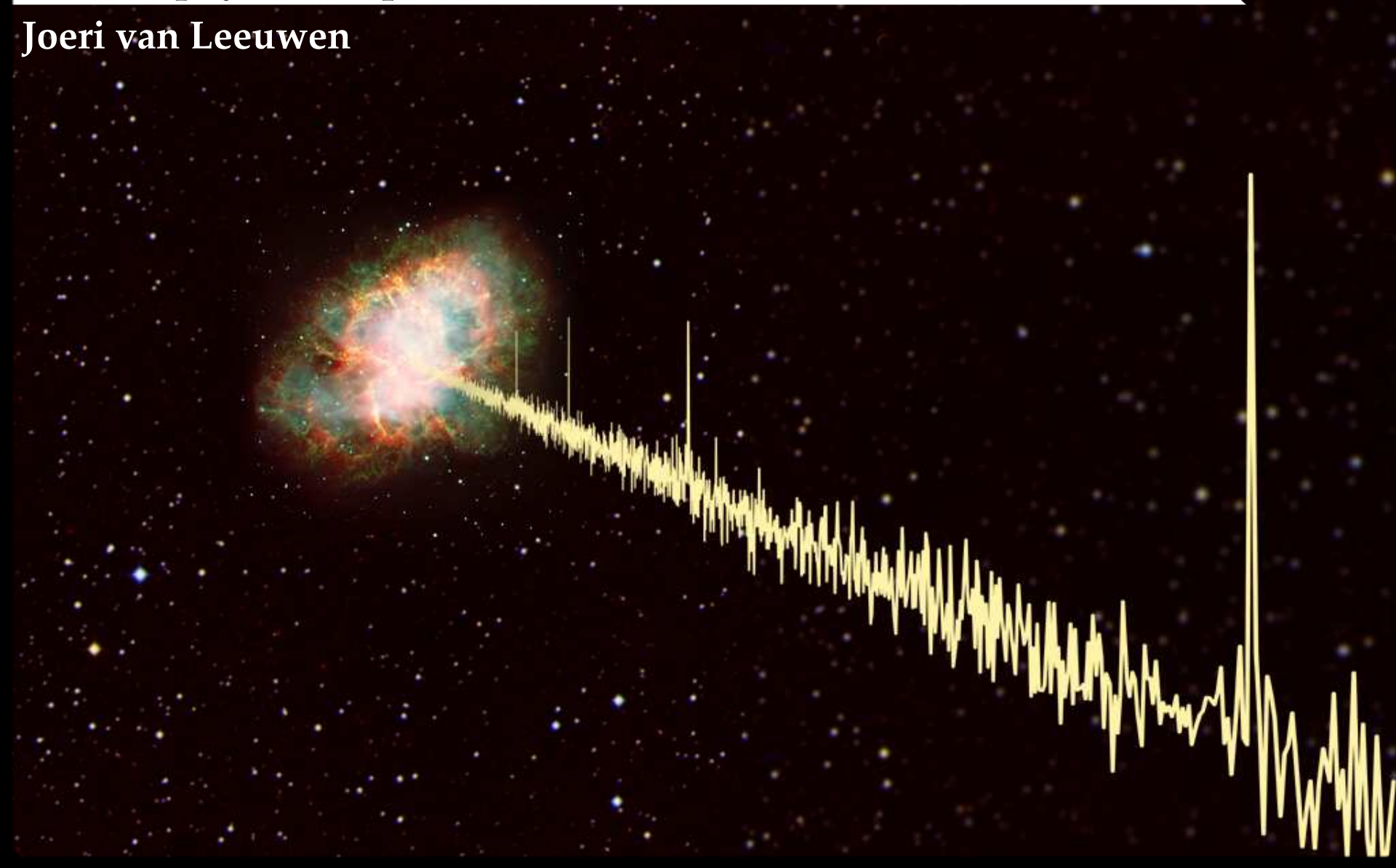
Extreme physics in space, seen with LOFAR

Joeri van Leeuwen



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"Pulsars", rotating neutron stars:

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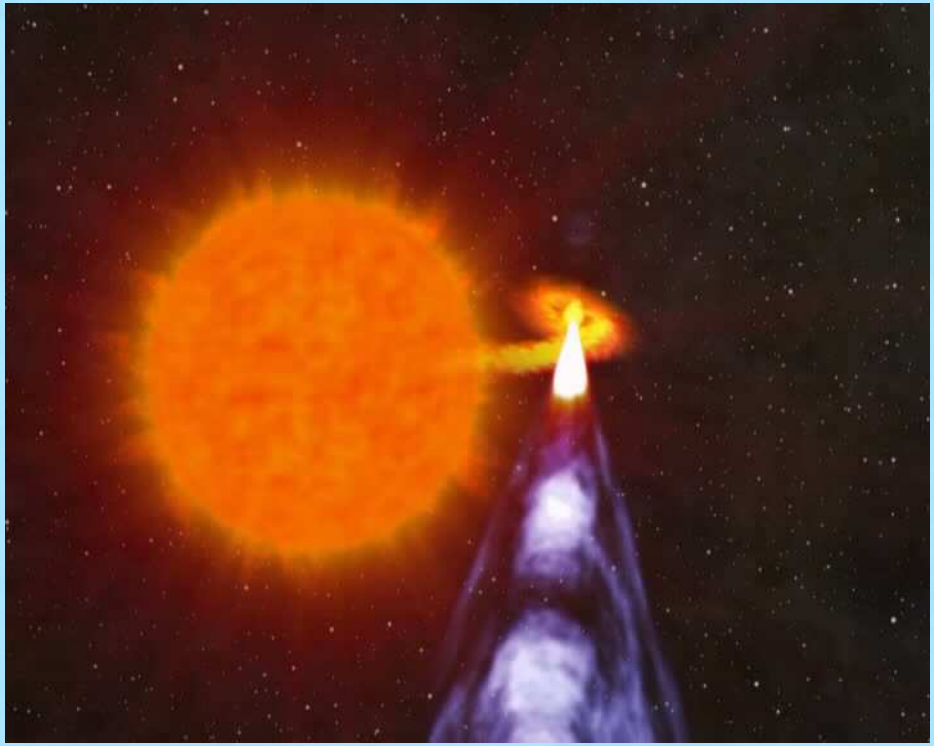
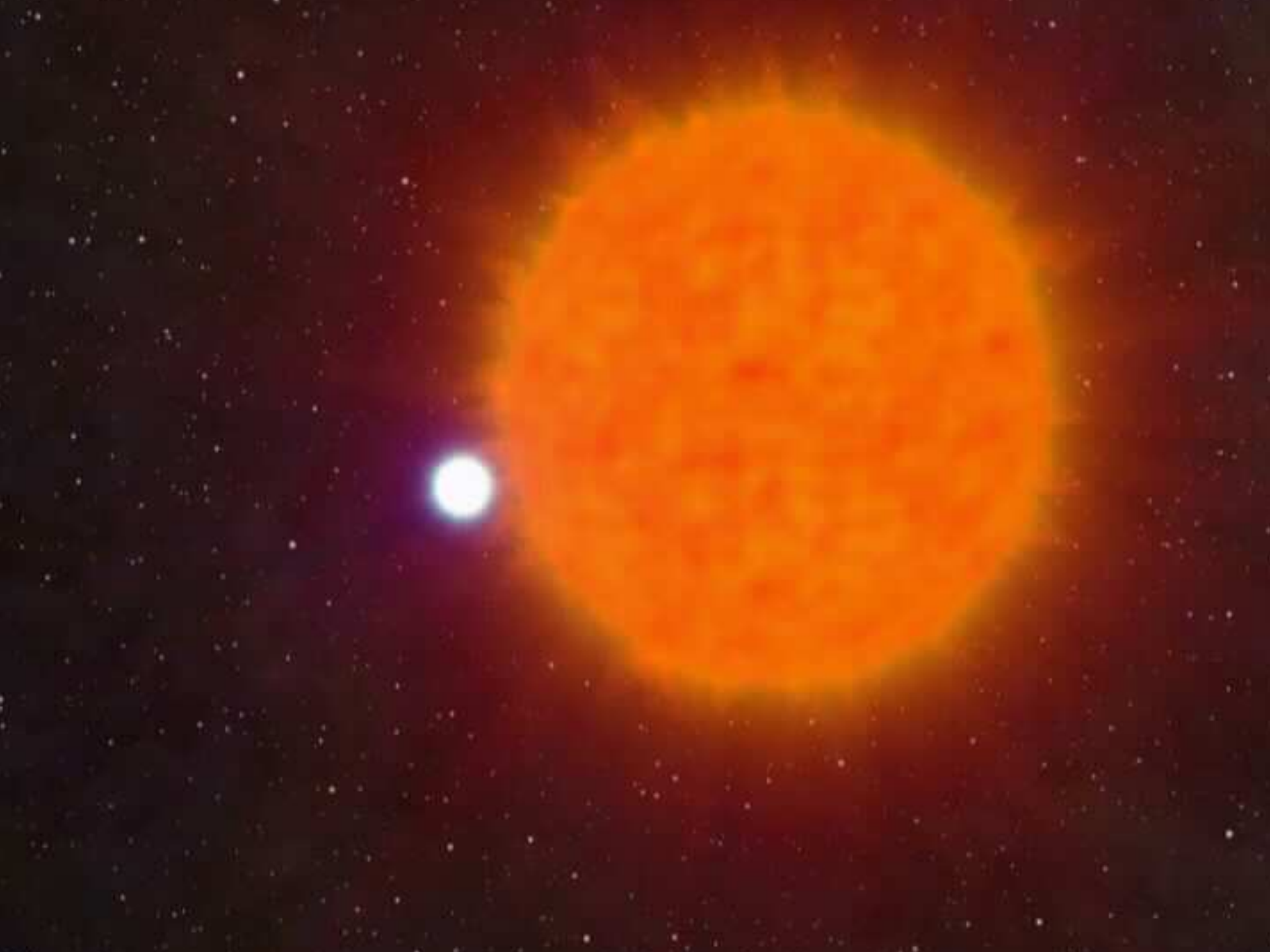
How are these formed?





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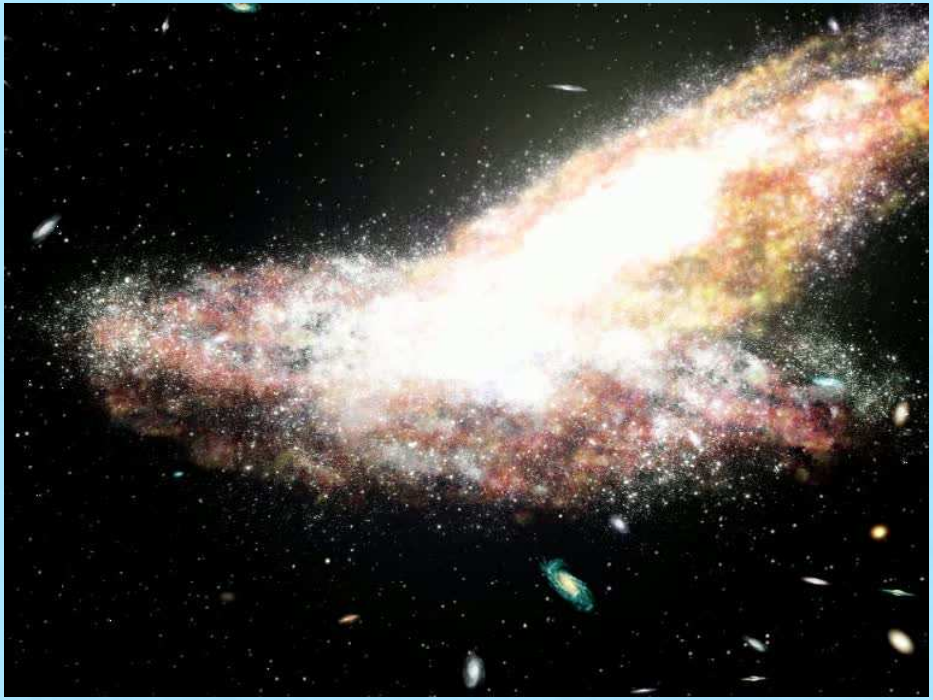
Pulsars are Nature's perfect clocks:



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The problem:

Finding radio pulsars in telescope data is computationally intensive,

"dedispersion" (shift-add rows in 2D data, collapse to 1D vector),
fourier transformations,
matched filtering

about 1,000 core-hrs per telescope hour

Our LOFAR pilot survey:
1000 telescope hrs -> 1 M core-hrs

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LOFAR are the 19 eyes

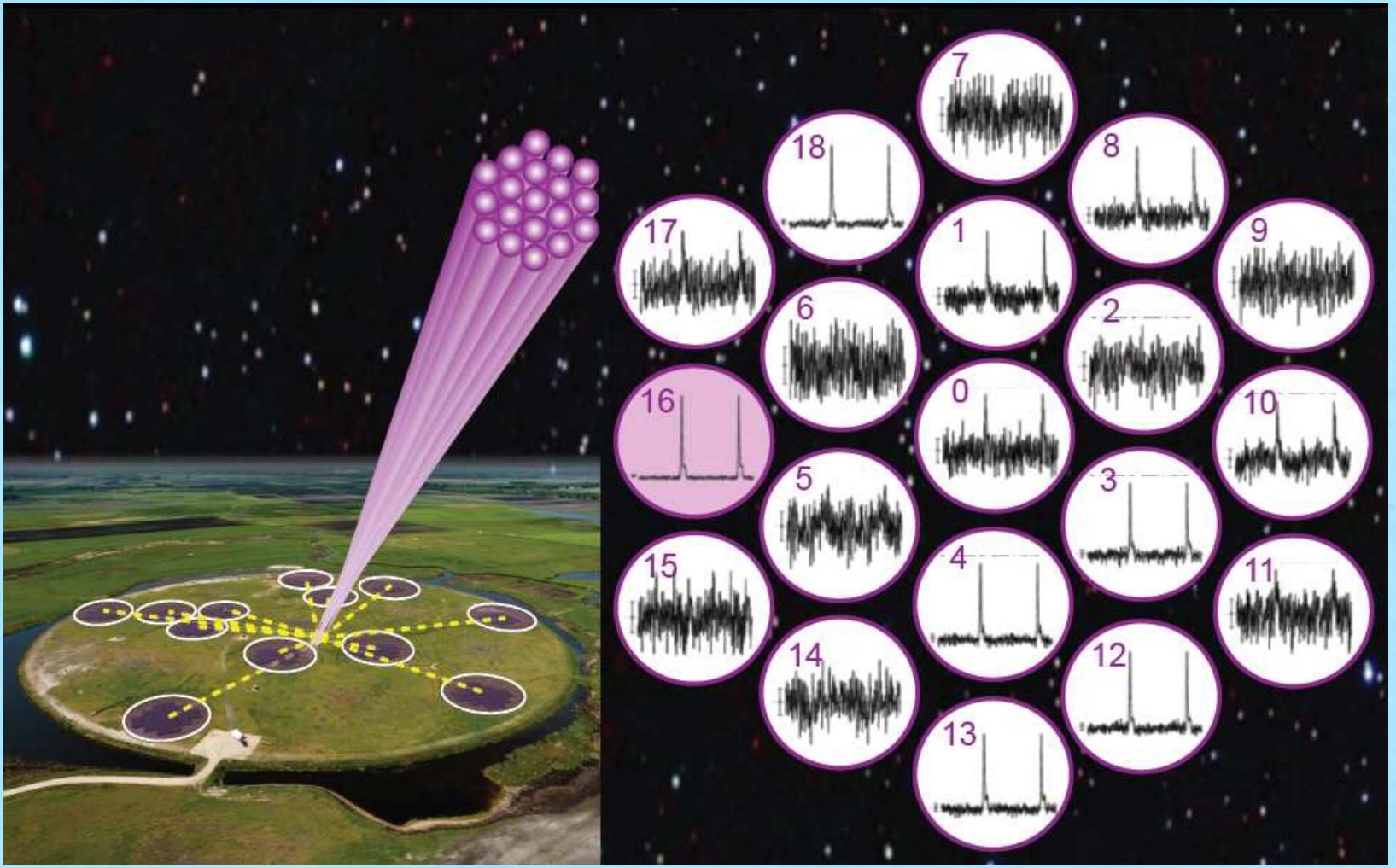

Figure courtesy of Jason Hessels

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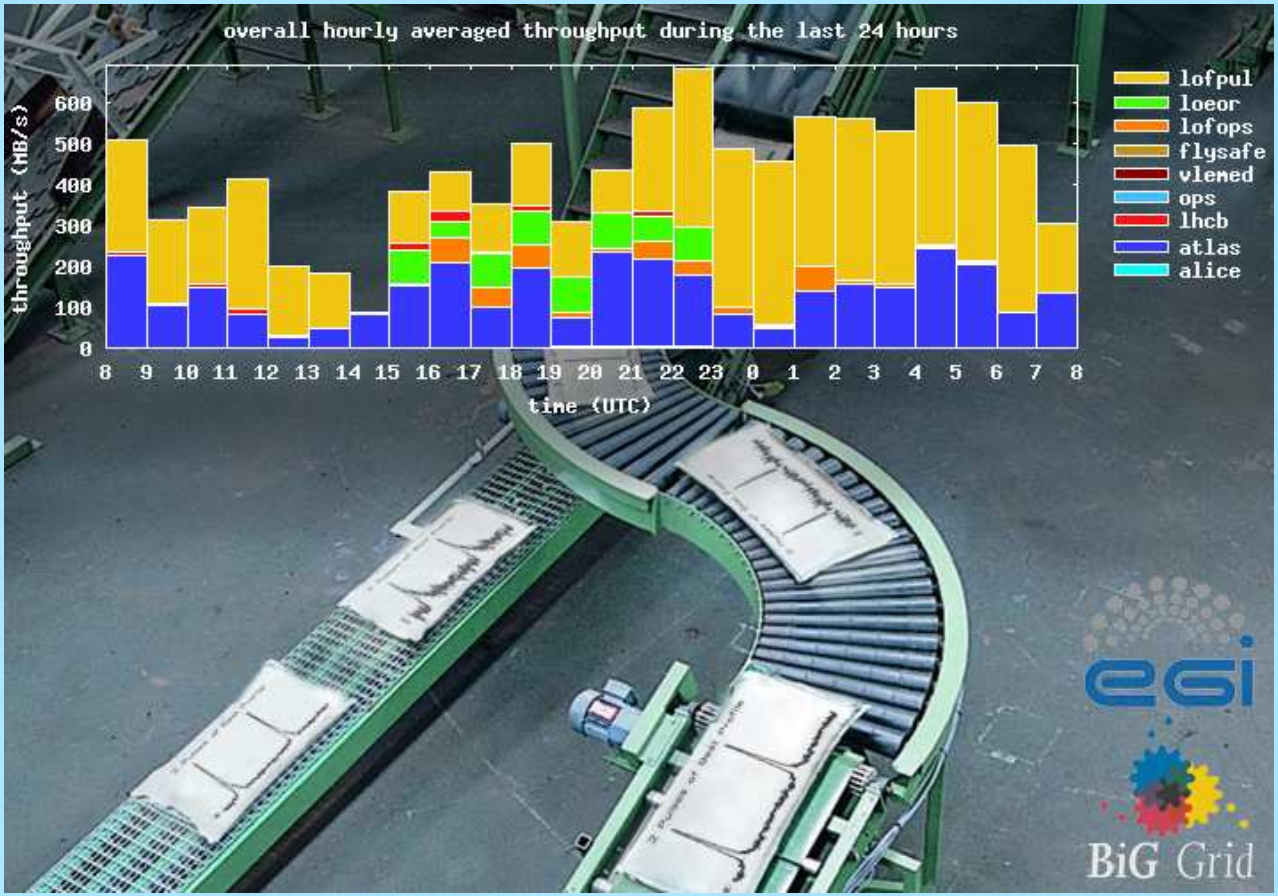
A LOFAR-GridStorage lightpath is the 10-Gbps optical nerve



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The grid (in this case BigGrid, EGI) is the memory and the brain (tape, cluster)

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Specific solutions for production:

- Wrapping our existing software suite for processing
  - Software is eclectic, some low-level parts are decades old
    - Validate compiles for each processing site
  - Software needs to run from set path – challenging in grid environment!
    - Wrap software in tarball, download and install for every job, link to e.g., /tmp/mysoftware-v01/ [a path that can always exist]
  - Most important lesson – get advice and support from your local NGI

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Specific solutions for production:

Pilot Jobs (JDL) + Token server (ToPoS)

Jobs pick up their instructions from a large pool of parameter files.

Results are uploaded to Grid Storage and combined at the end.

Results summaries are uploaded as new tokens

Monitoring of job (re-)submission and result validation

With a set of simple command-line scripts, checked roughly weekly.

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Results:

- Two new pulsars detected – the *first ever* with LOFAR
- Already resulting in 1 PhD thesis and 1 refereed paper