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What can SETI researchers learn from FRBs…

Mike Garrett

Sir Bernard Lovell Chair of Astrophysics,

Director Jodrell Bank Centre for Astrophysics (JBCA).

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"All-sky" Radio SETI

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Success in SETI might be difficult…

So far no obvious SETI signals have been detected.

Thus far, Astronomical data in general show no signatures of advanced civilisations.

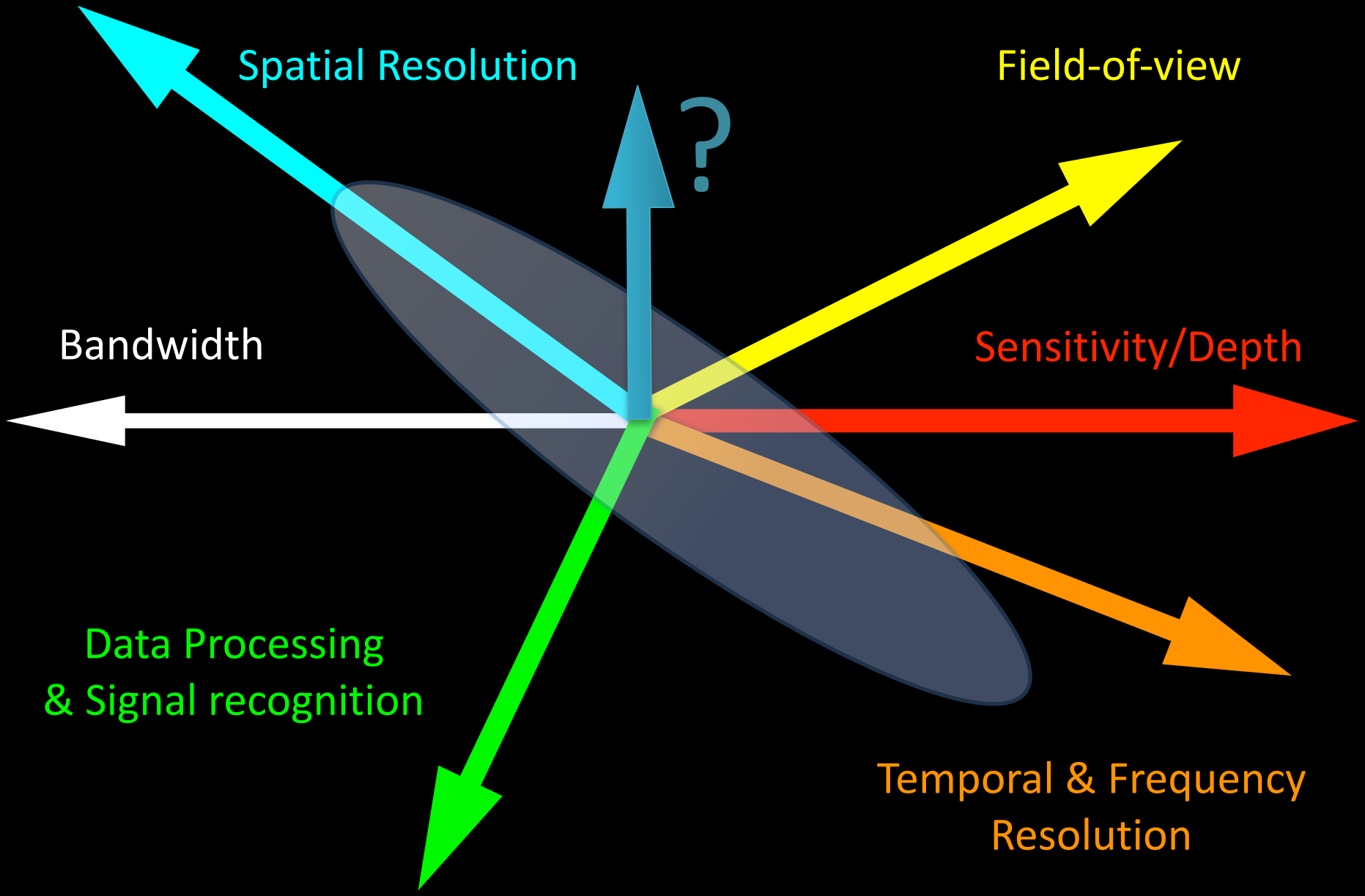
Solar system is apparently pristine with no evidence of past visitations.

Intelligent life capable of communicating on galactic scales took a long time to arise on this planet, and may be universally “rare”.

Milky Way is big, old and the speed of light is finite.

From “our experience of one" technical (radio phase) civilisations may have v. short lifetimes…

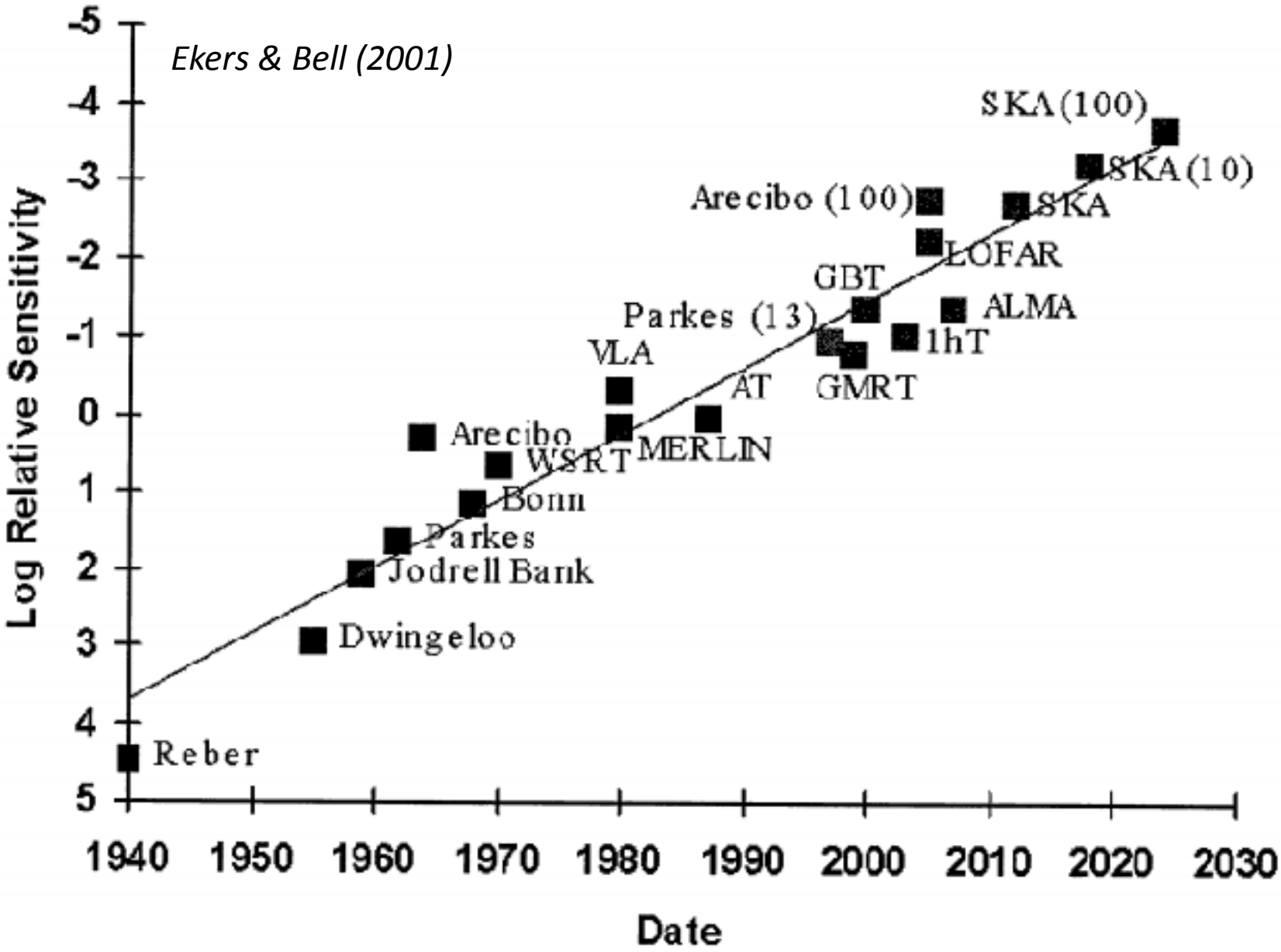
SETI Success



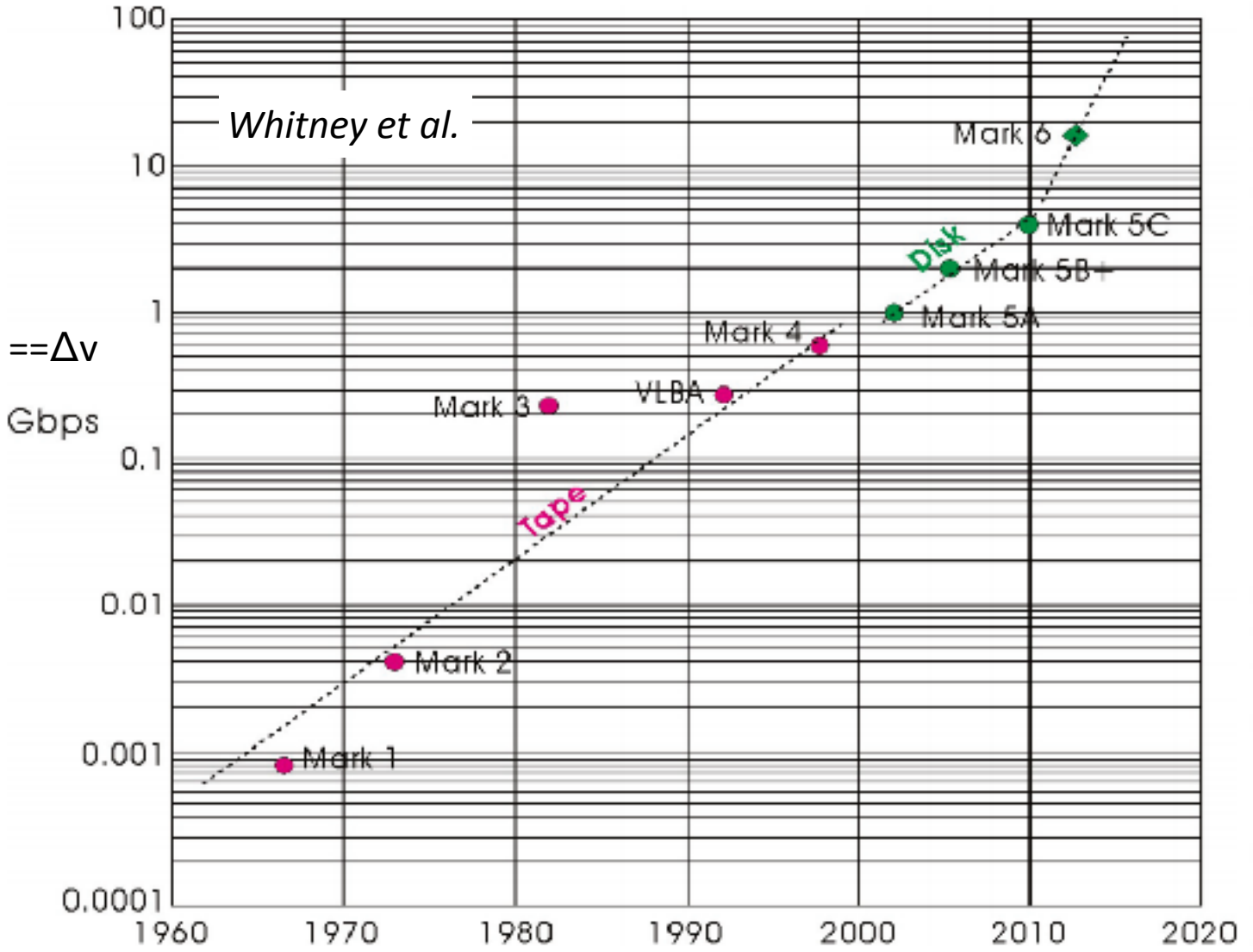
What can we learn from Fast Radio Bursts (FRBs) ?

FRBs are bright - easily beyond the detection threshold of most radio telescopes for many decades.

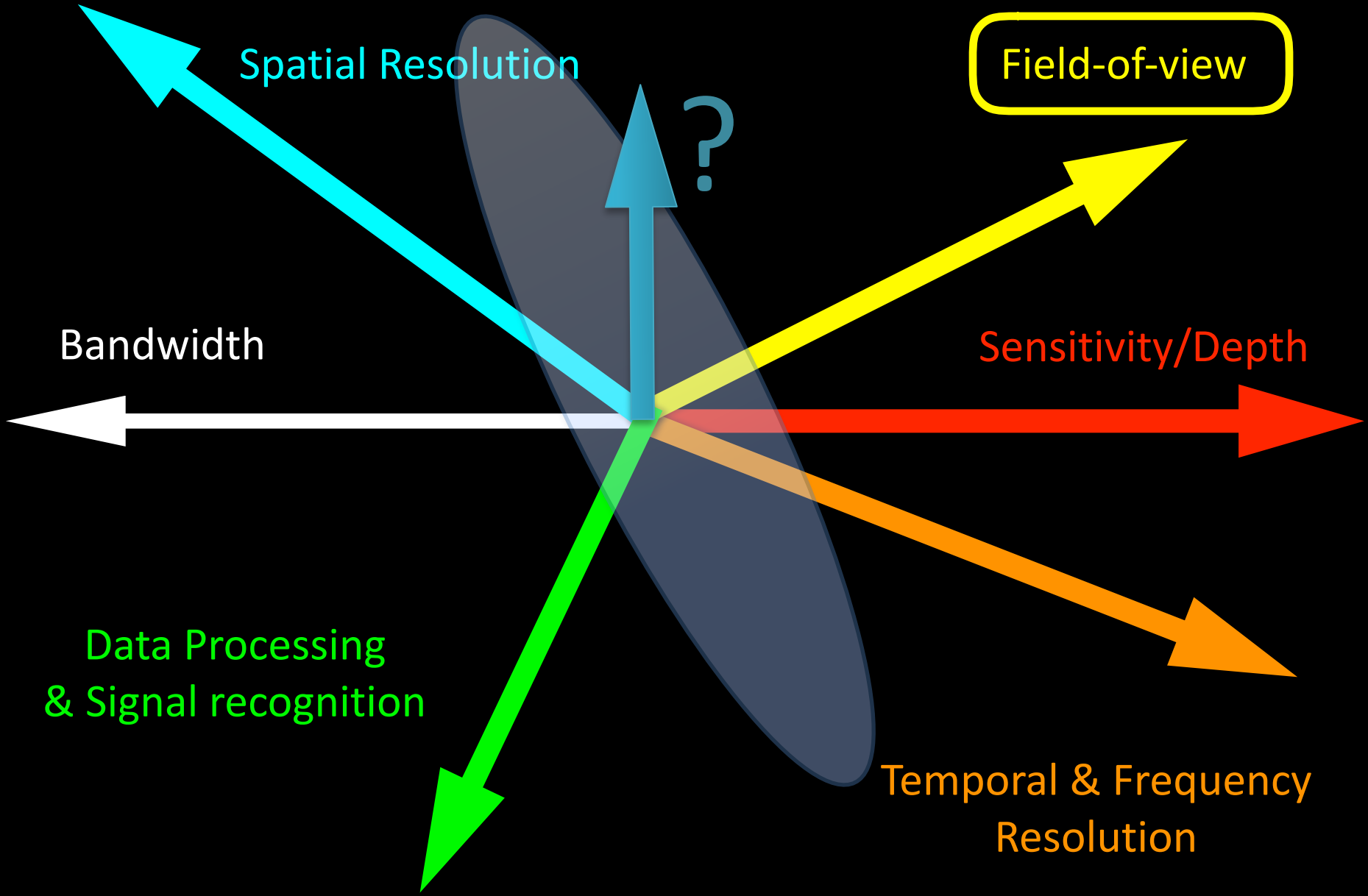
- Radio astronomy has enjoyed exponential gains in sensitivity…



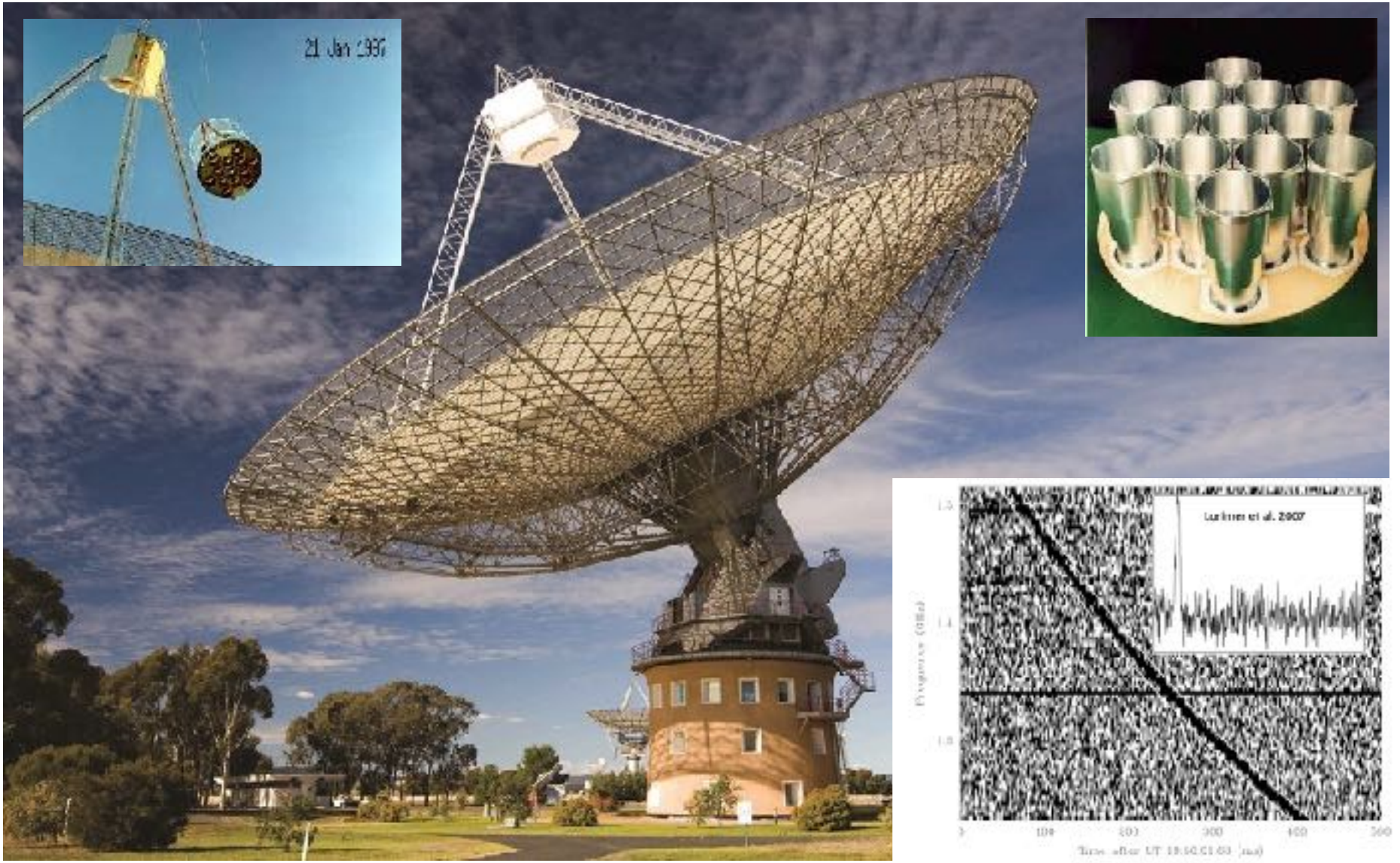
- Exponential gains in instantaneous bandwidth too…



SETI Success



No coincidence that even the few FRBs we have detected, had to wait for the development of multi-horn receivers…

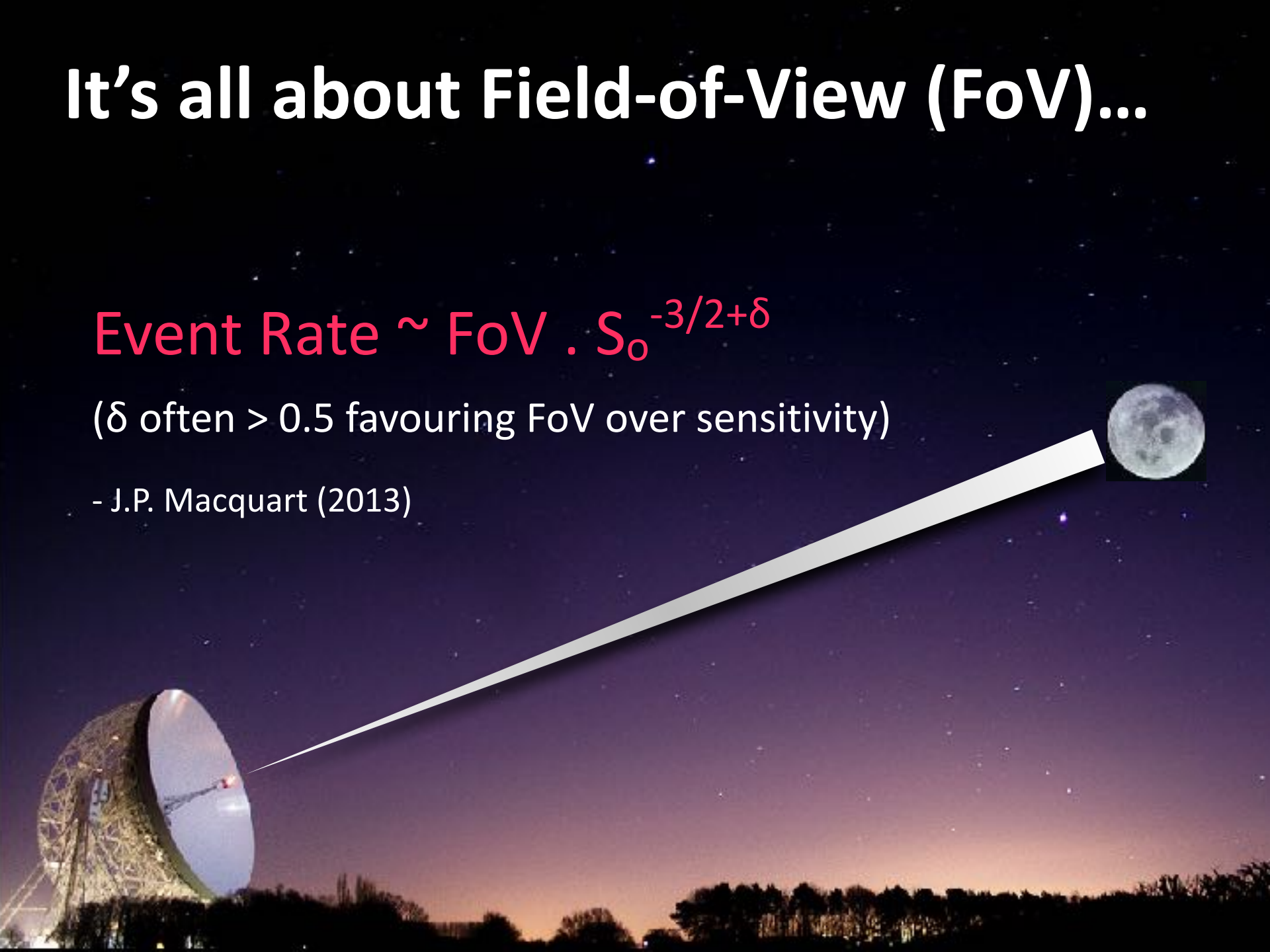


It's all about Field-of-View (FoV)…

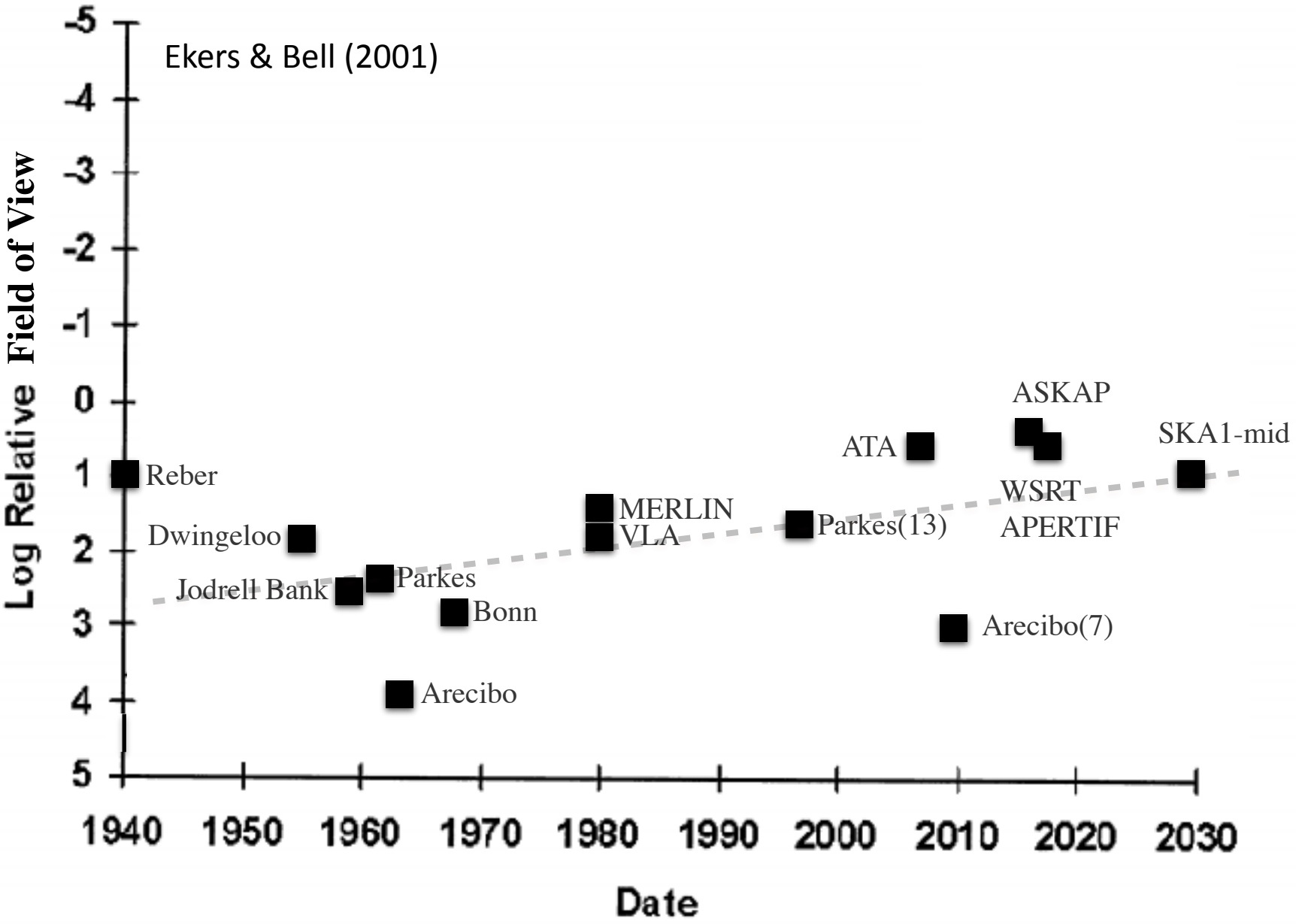
Event Rate ~ FoV . $S_o^{-3/2+\delta}$

(δ often > 0.5 favouring FoV over sensitivity)

- J.P. Macquart (2013)



- Very modest gains in field-of-view at cm wavelengths…



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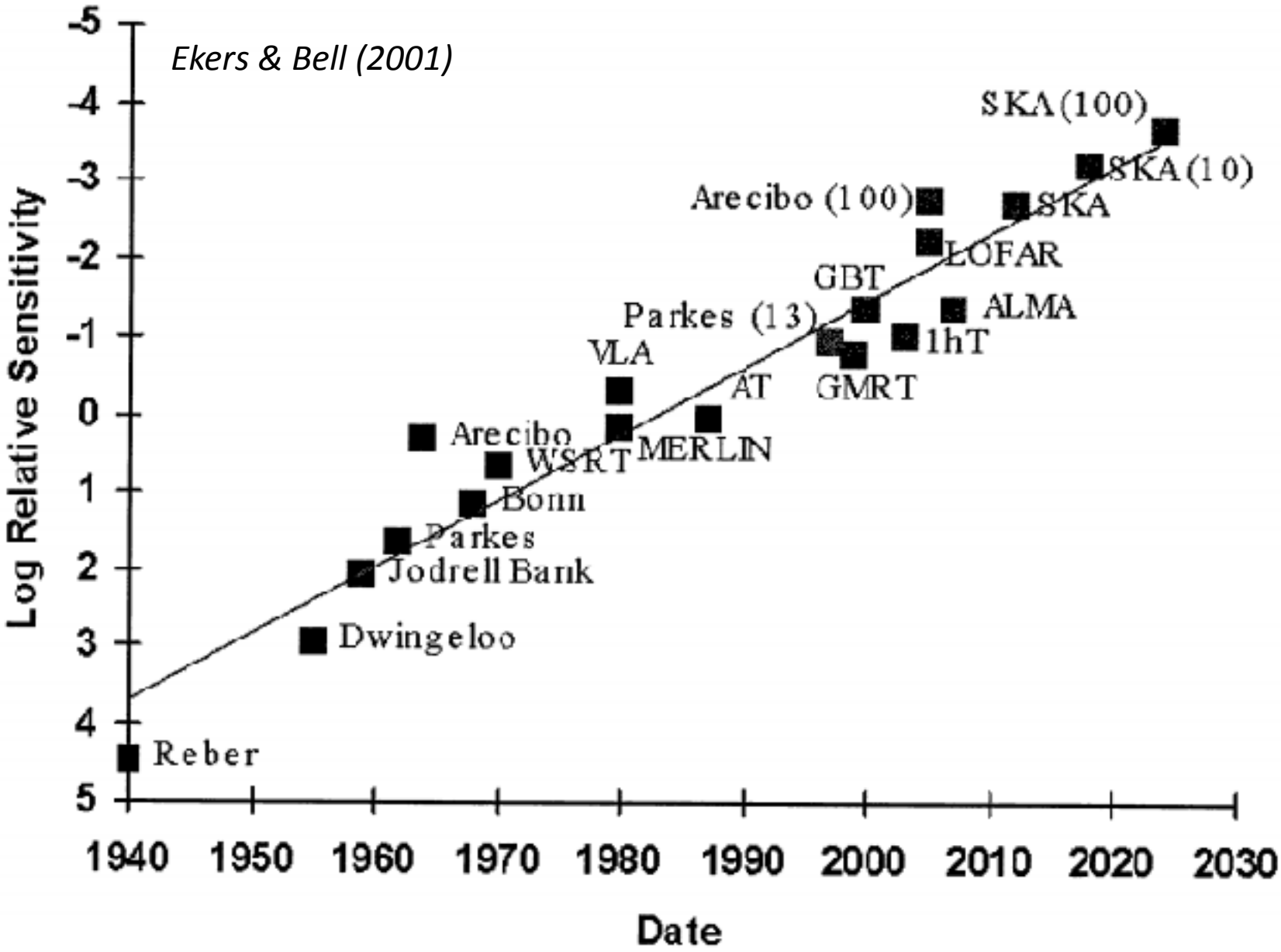

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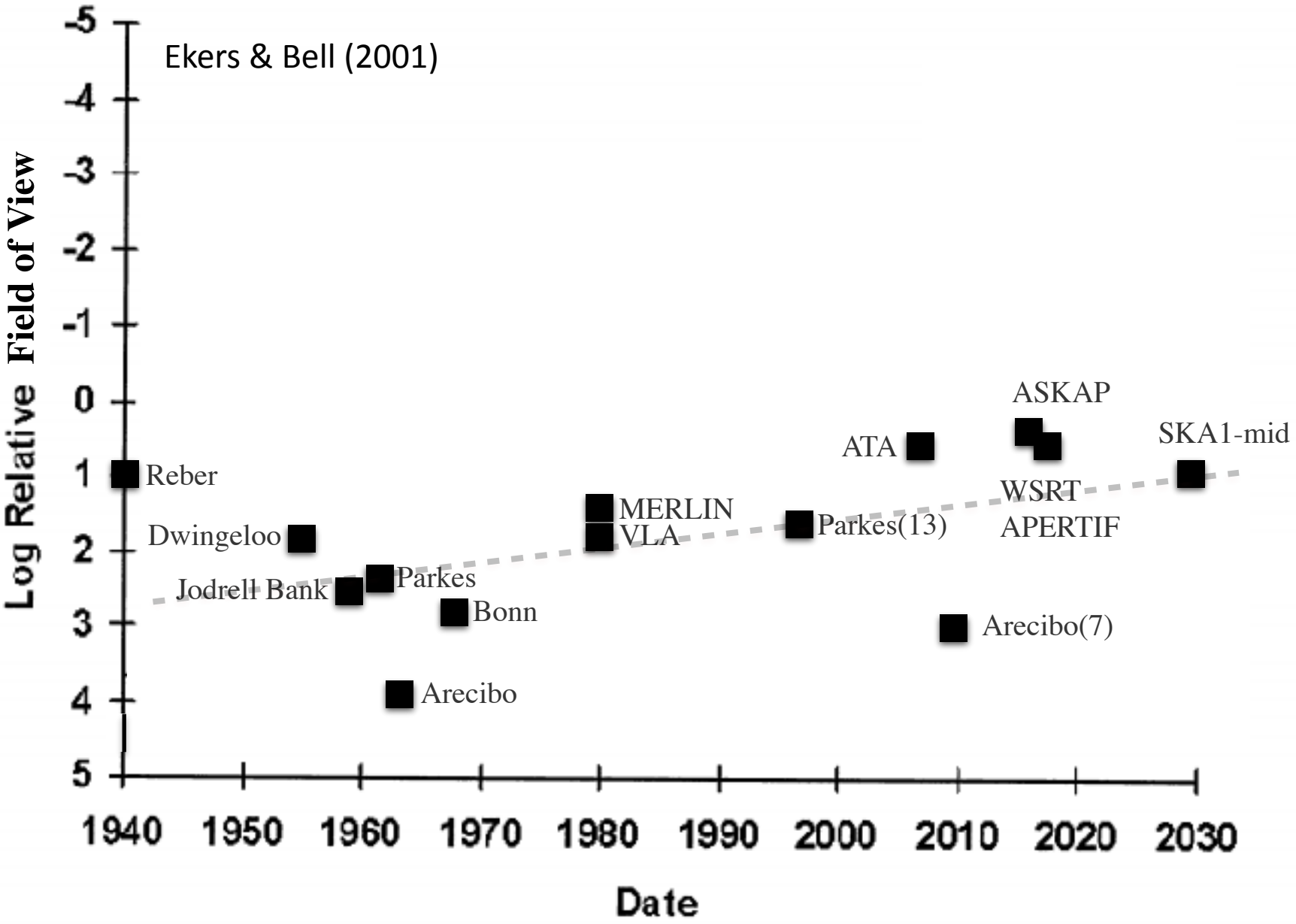

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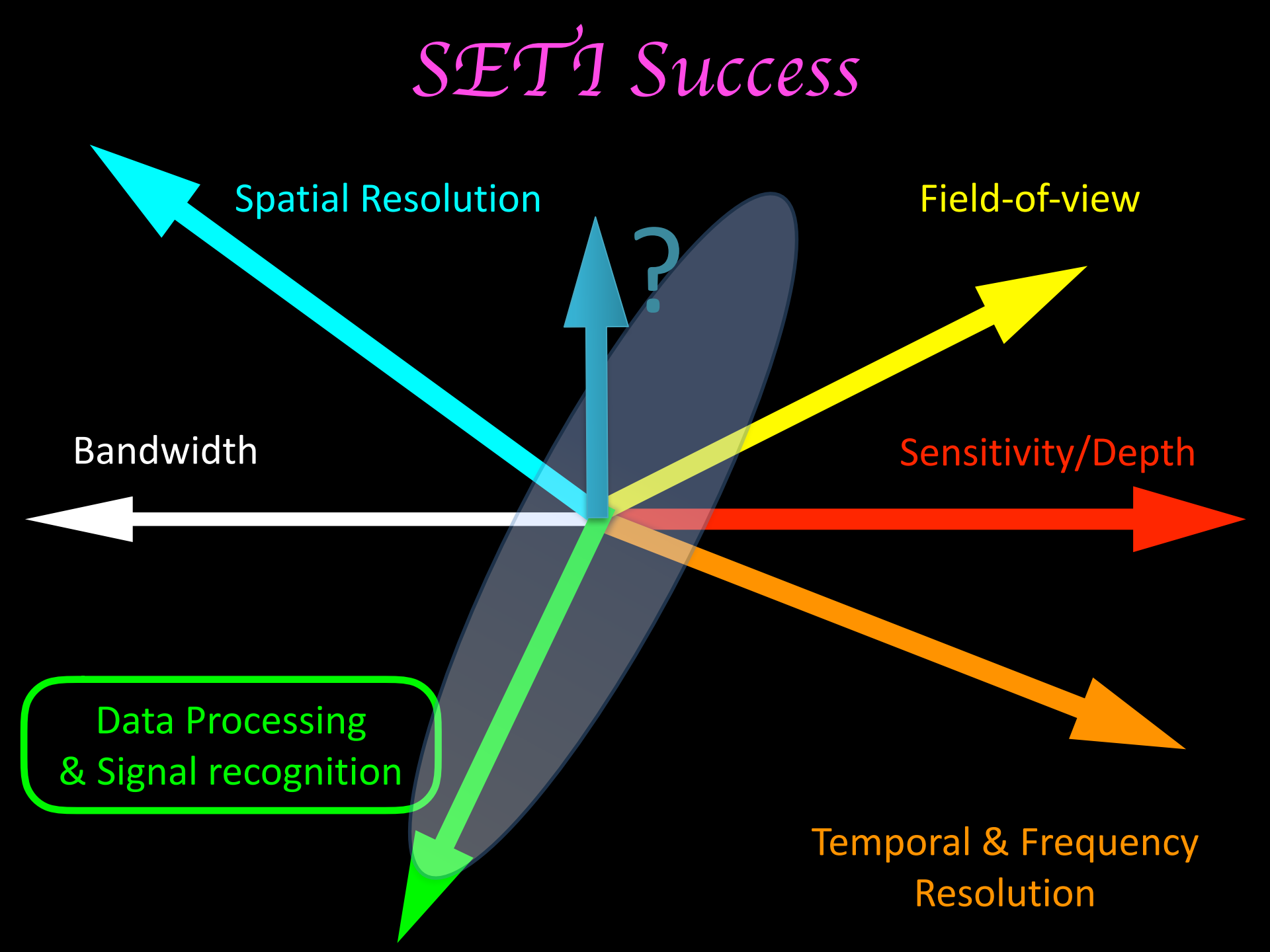
Despite being bright and with a VERY high event rate, Field-of-View is crucial…

SETI Success



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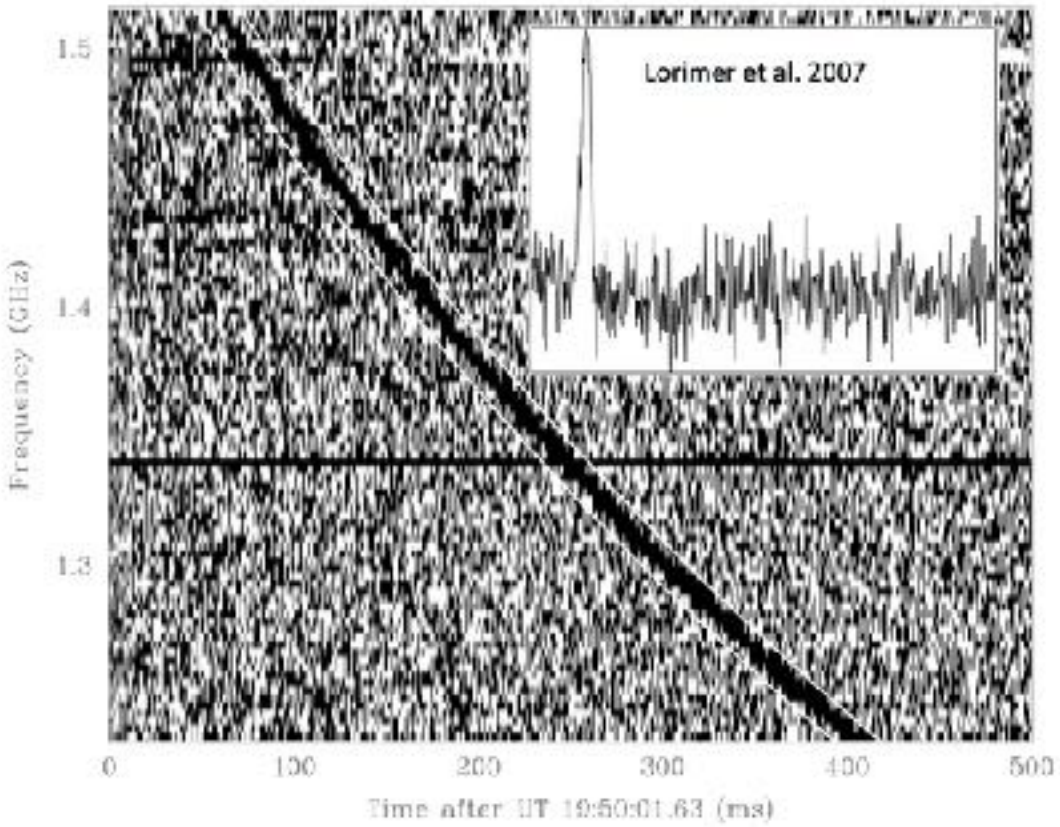

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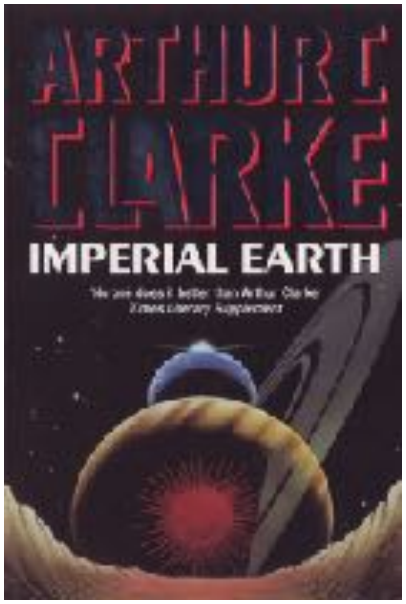
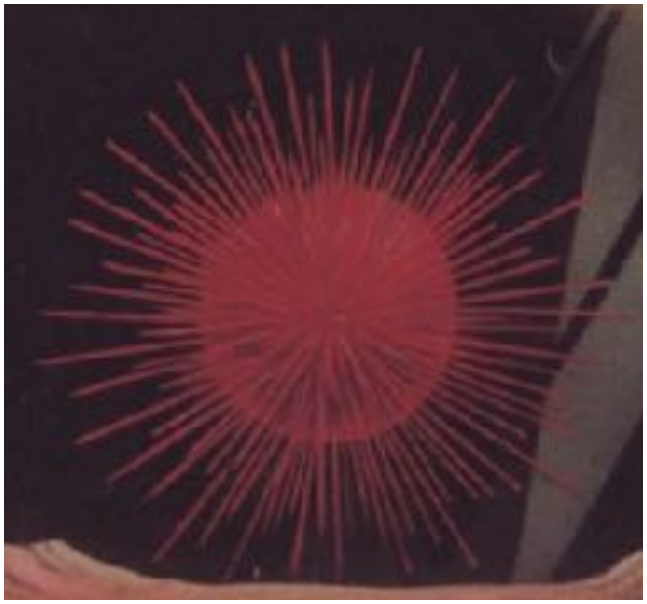
FRBs were sitting in the raw archive data just waiting to be discovered…

Phased Array Feeds (PAFs) increase FoV by ~ x10.

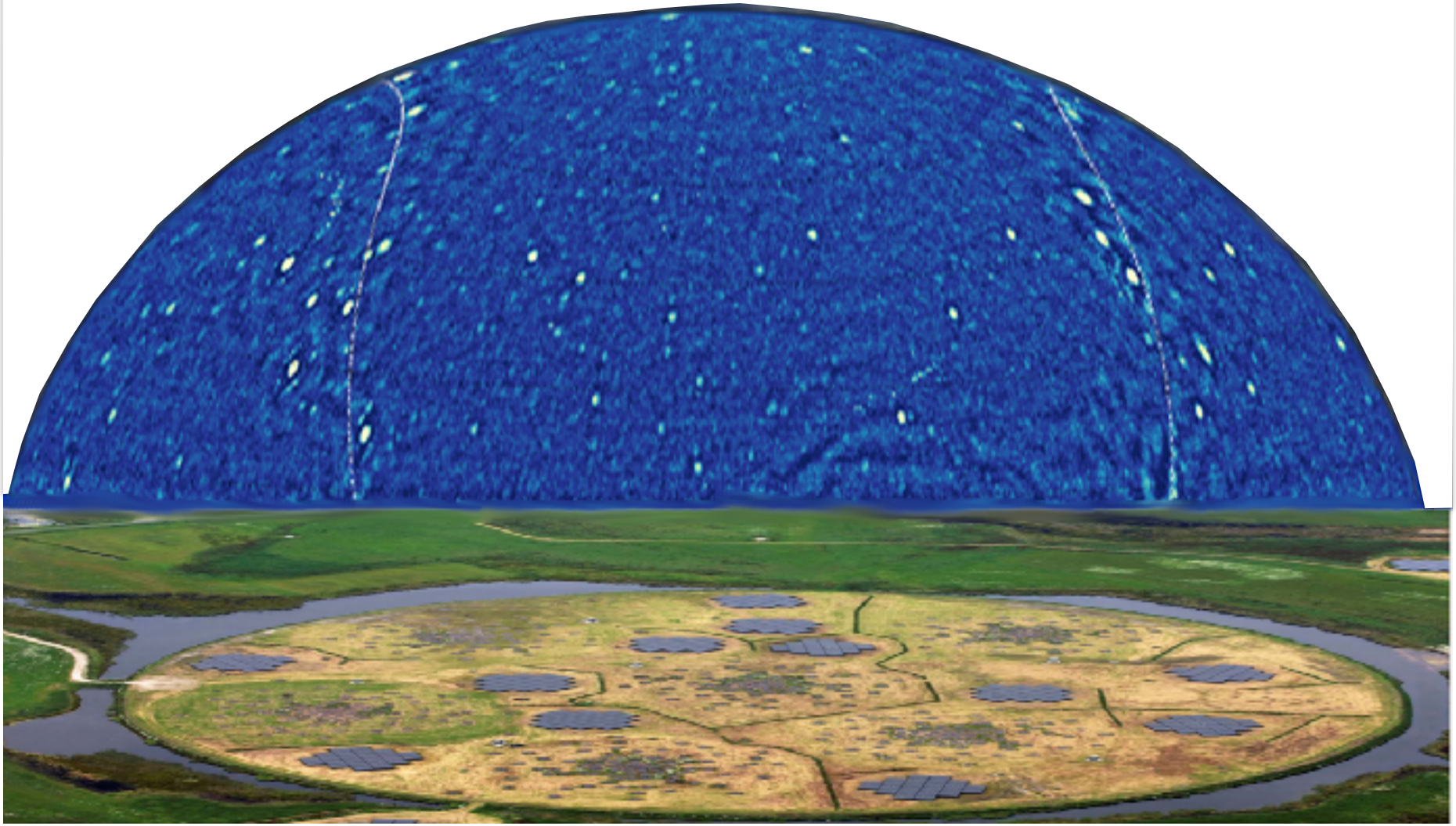




First "all-sky" SETI concept - *Argus* - is well-described in "Imperial Earth"

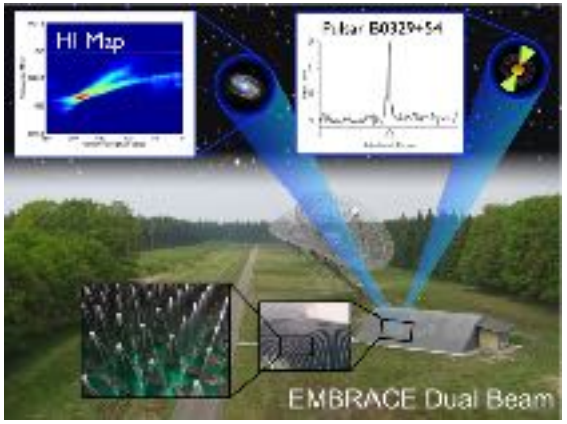
"Argus - multiple-eyed god, who could look in every direction simultaneously. Unlike poor Cyclops, who had only a single line of vision".

Progress at low frequencies (< 300 MHz or 1m) e.g. MWA & LOFAR AARTFAAC telescopes

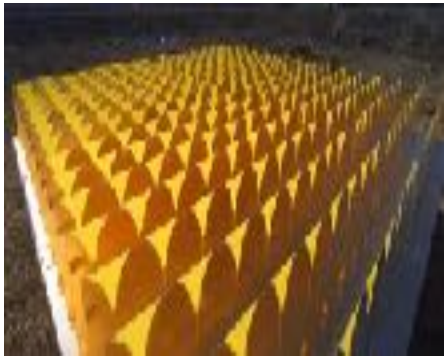


Prototype Aperture Array cm-wavelength antenna and beam-forming technology (e.g. van Ardenne et al.)

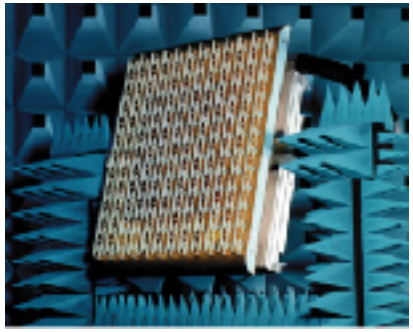
EMBRACE 2012



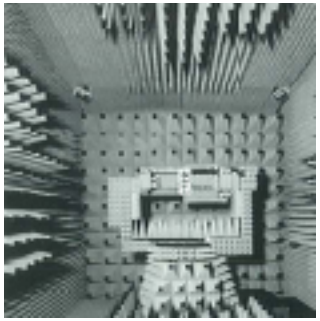
THEA 2004



OSMA 1999

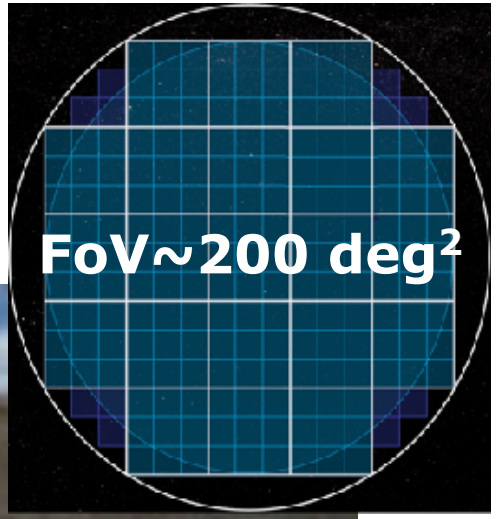


AAD 1997



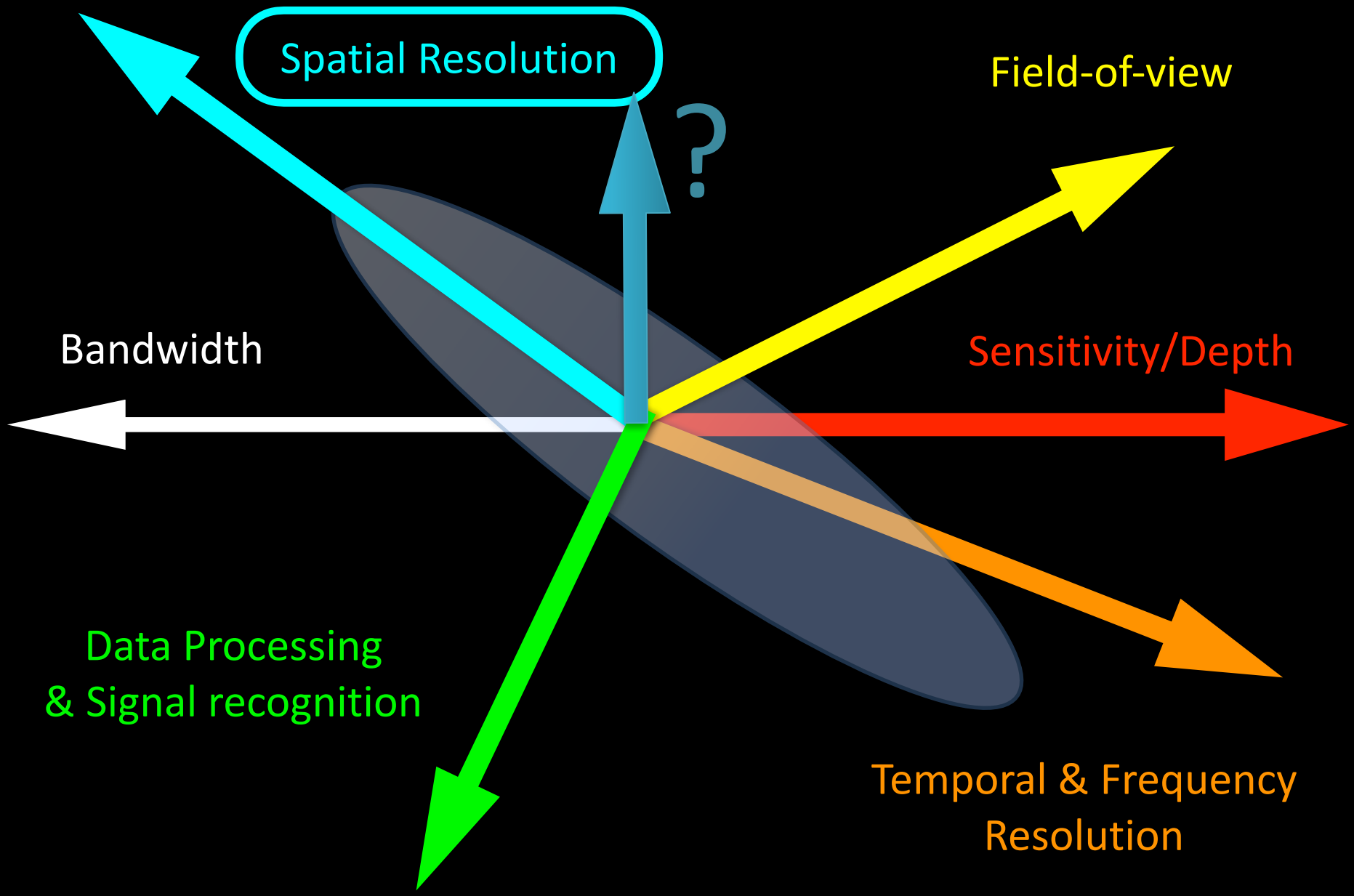
See van Ardenne et al. 2012

Dedicated SETI instruments…?



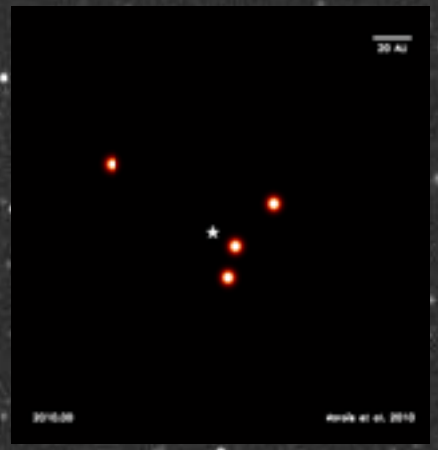
0.45-1.45GHz, A~1500-2500m^2, SEFD ~ 74-44Jy

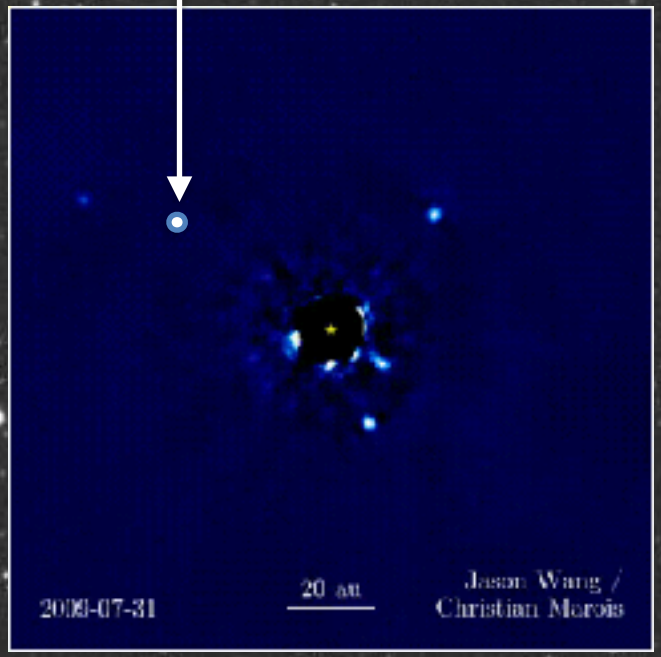
AFTER *SETI Success!*

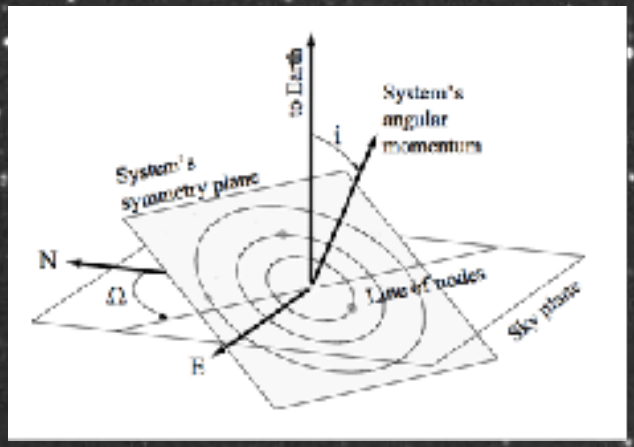



Primary beam
GBT @ 1.4GHz

HR 8799 150 milliarcsecs = 5 AU @130 lyr.







Full Keplerian solution to orbits should be possible together with RV data.

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LOCATION! LOCATION! LOCATION! == Interferometry…

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Thank you!