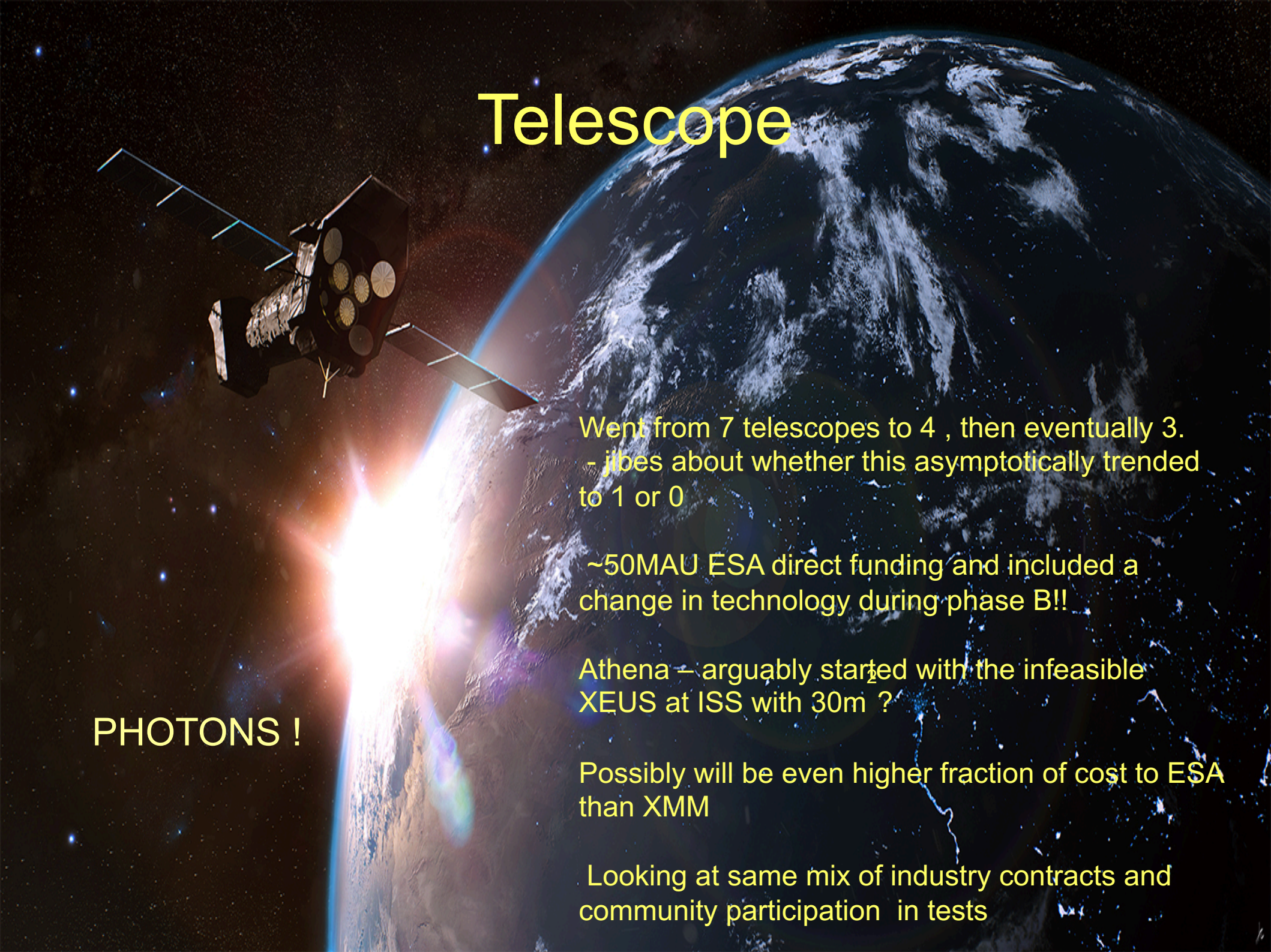
XMM-Newton Recollections

Heritage:
I use opportunity to highlight selection of points from XMM-Newton
Does anything inform what we need to carry forward for ***Athena?***

Telescope



PHOTONS !

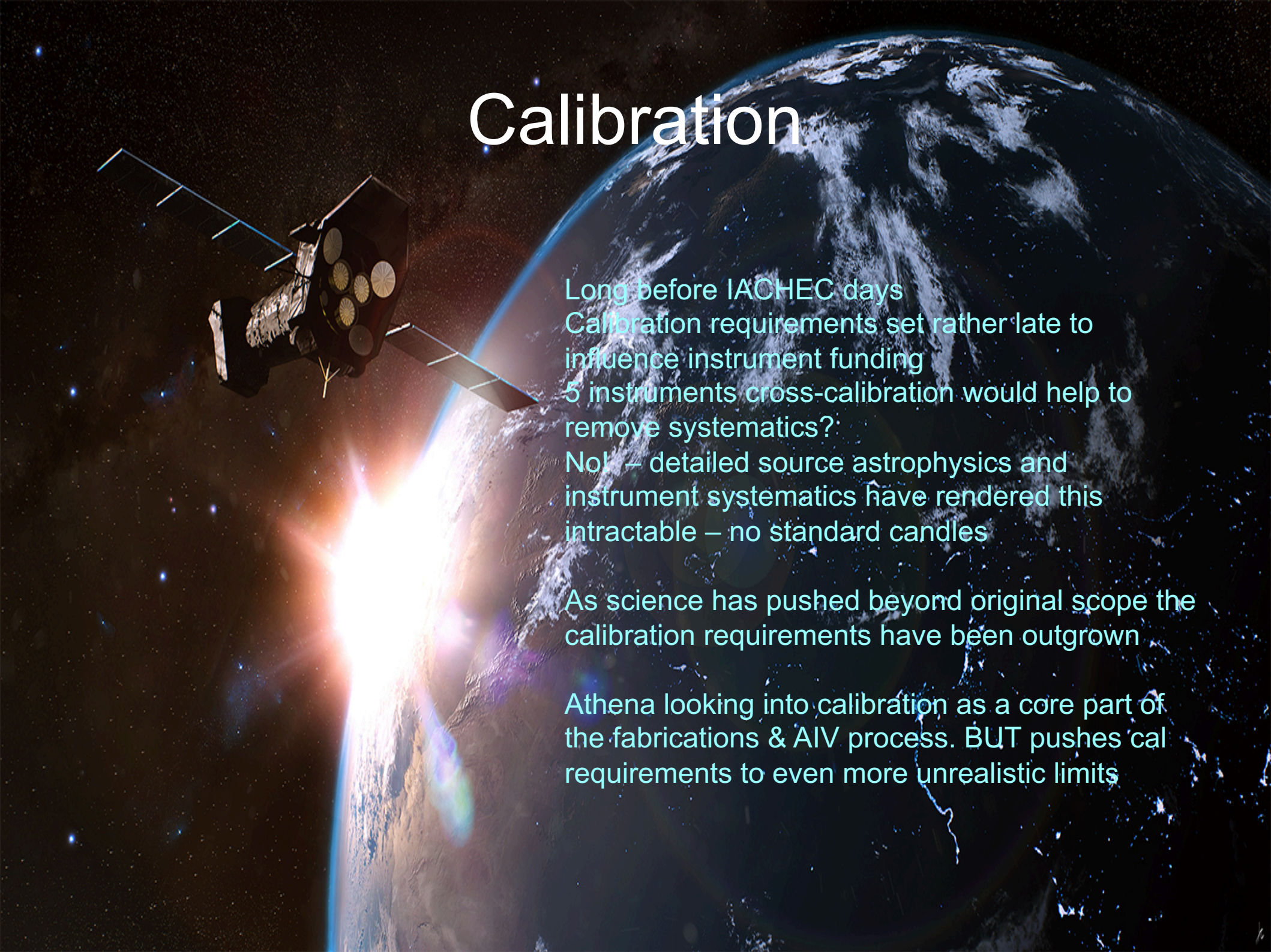
Went from 7 telescopes to 4 , then eventually 3.
- jibes about whether this asymptotically trended to 1 or 0

~50MAU ESA direct funding and included a change in technology during phase B!!

Athena – arguably started with the infeasible XEUS at ISS with 30m ?

Possibly will be even higher fraction of cost to ESA than XMM

Looking at same mix of industry contracts and community participation in tests



Calibration

Long before IACHEC days
Calibration requirements set rather late to influence instrument funding
5 instruments cross-calibration would help to remove systematics?
No! – detailed source astrophysics and instrument systematics have rendered this intractable – no standard candles

As science has pushed beyond original scope the calibration requirements have been outgrown

Athena looking into calibration as a core part of the fabrications & AIV process. BUT pushes cal requirements to even more unrealistic limits

Orbit

Low Earth Orbit originally conceived was incompatible with thermal requirements

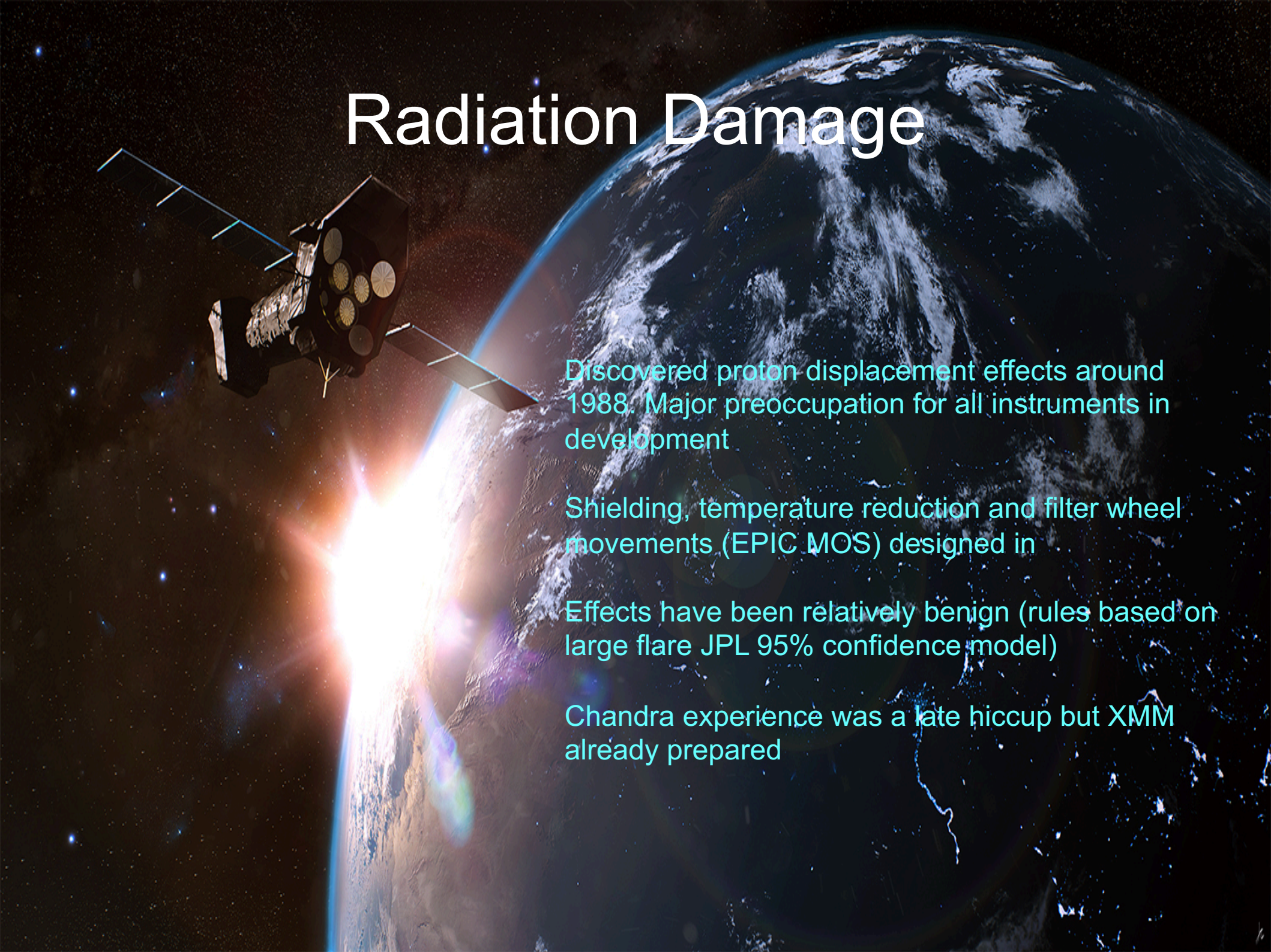
EXOSAT 4 days orbit experience was a strong justification for HEO of XMM

Localised soft proton magnetic reconnection events unexpected (hindsight)

Lack of earth's shielding of GCR and much longer focal length – effect on background

Similar arguments being revisited for Athena but L2

Radiation Damage



Discovered proton displacement effects around 1988. Major preoccupation for all instruments in development

Shielding, temperature reduction and filter wheel movements (EPIC MOS) designed in

Effects have been relatively benign (rules based on large flare JPL 95% confidence model)

Chandra experience was a late hiccup but XMM already prepared

Instruments

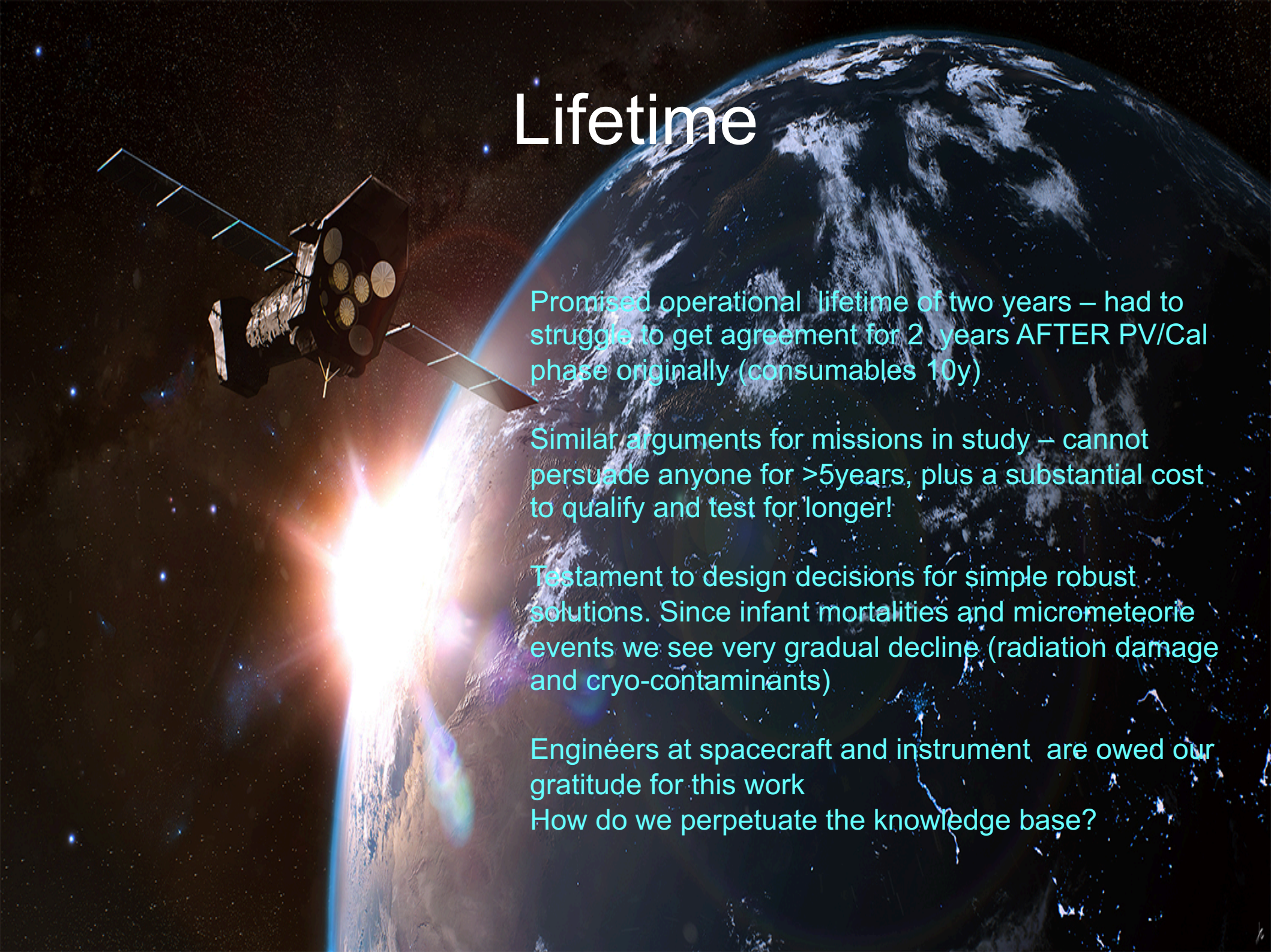
CCDs had not been flown for X-ray astronomy before XMM development phase began and payload AO released (ASCA 1993)

Novel grating design

ESA supported key developments early on (TRL ?)

Athena will use completely novel pixel detectors (WFI) and cryogenic spectrometer that is many multiples more difficult than HITOMI !

Lifetime



Promised operational lifetime of two years – had to struggle to get agreement for 2 years AFTER PV/Cal phase originally (consumables 10y)

Similar arguments for missions in study – cannot persuade anyone for >5years, plus a substantial cost to qualify and test for longer!

Testament to design decisions for simple robust solutions. Since infant mortalities and micrometeorie events we see very gradual decline (radiation damage and cryo-contaminants)

Engineers at spacecraft and instrument are owed our gratitude for this work
How do we perpetuate the knowledge base?