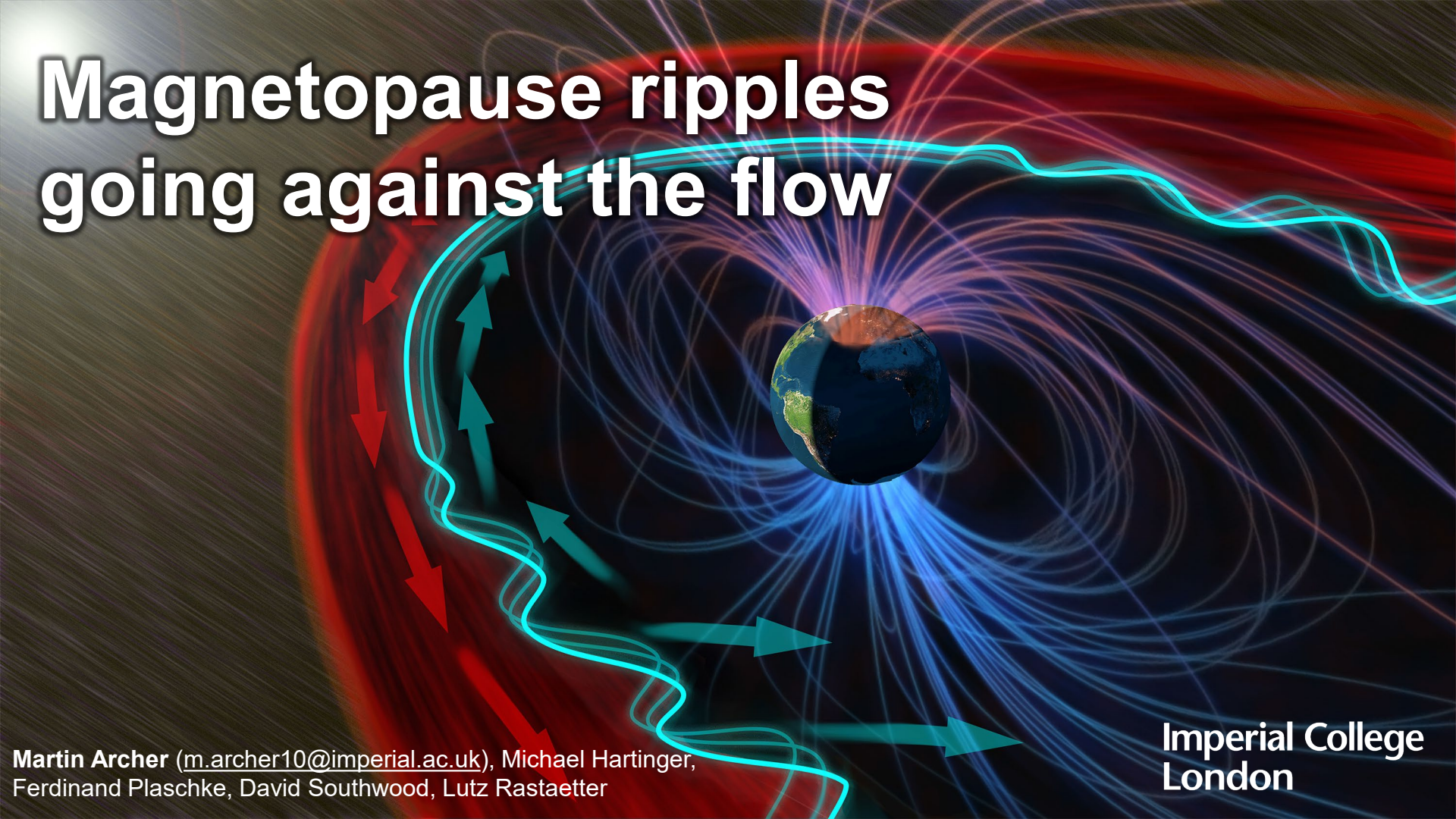
Magnetopause ripples going against the flow



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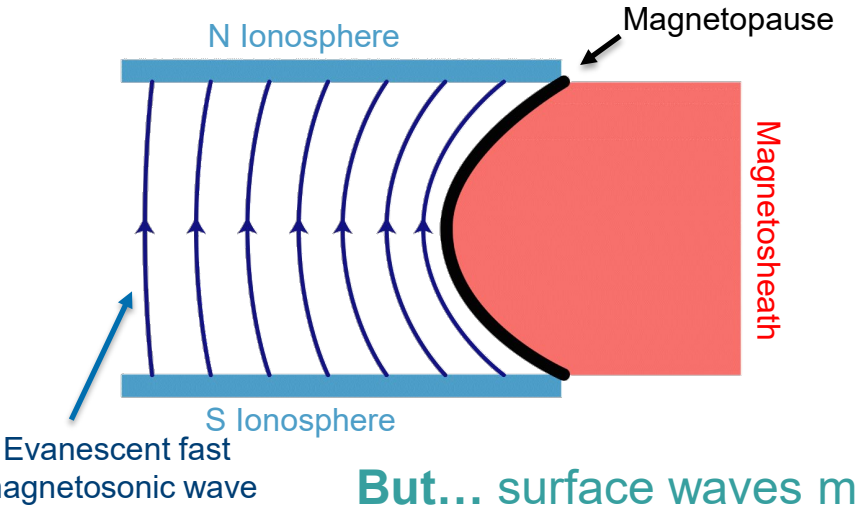
Magnetopause surface eigenmodes

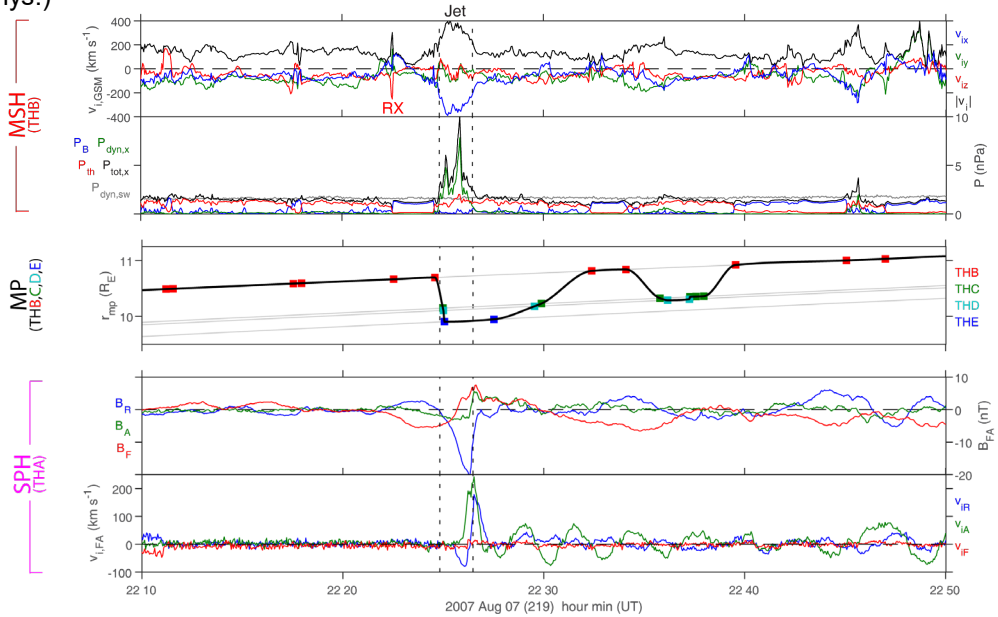
Lowest frequency normal mode of magnetosphere

(Chen & Hasegawa, 1974, JGR; Plaschke & Glassmeier, 2011, Ann. Geophys.)

Discovered at Earth's magnetopause through THEMIS multi-spacecraft observations



(Archer+, 2019, Nature Comm.)



But… surface waves must be advected by tailward magnetosheath flow

How can these waves get trapped locally away from noon local time?

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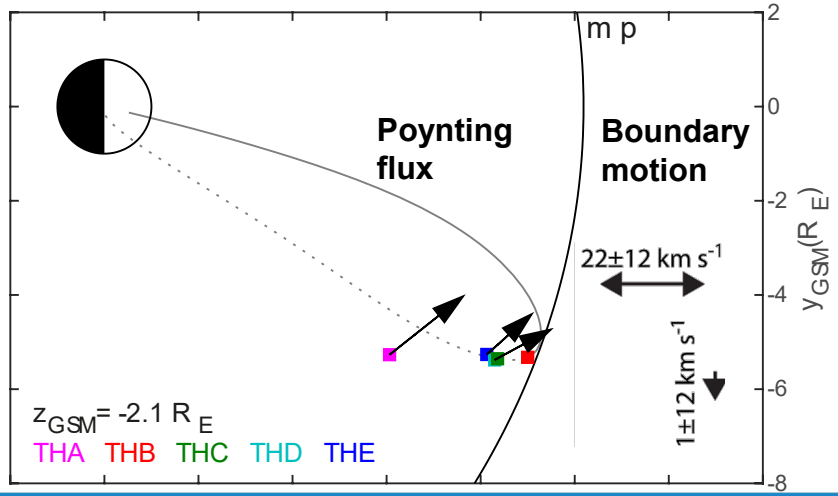
Poynting flux

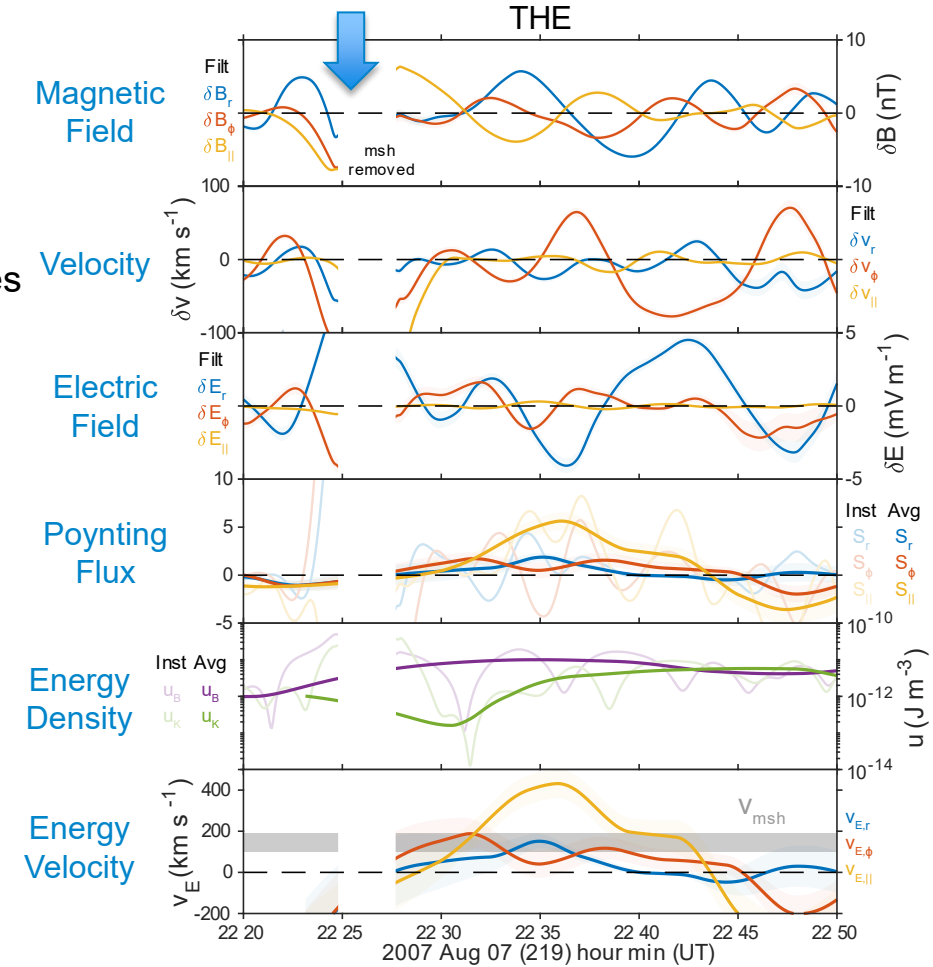
Poynting vectors surprisingly point sunward

Opposite to typical externally excited surface & body waves

Energy velocity comparable to magnetosheath flow

Suggests opposing energy fluxes balance resulting in no net energy flow, i.e. an **azimuthally stationary wave**





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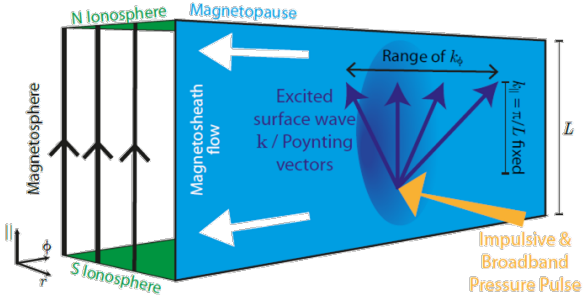
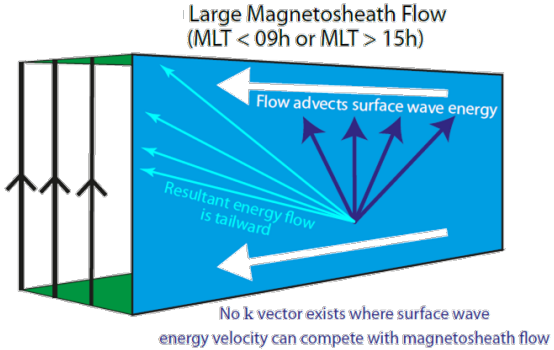
High-res global MHD simulation

Poynting & advective fluxes balance over wide MLT range

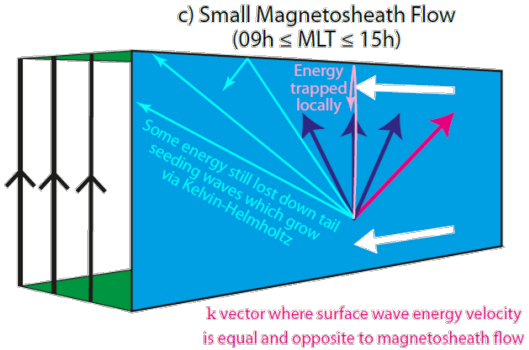


Explains global response of the magnetopause to impulsive driving

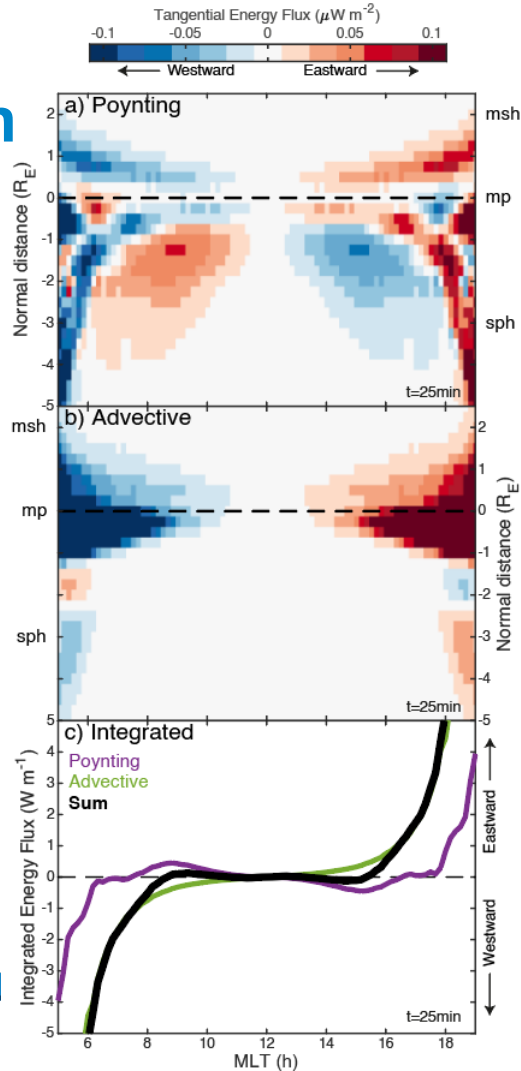
Implications throughout system



Tailward propagating surface waves (Typical paradigm)



Azimuthally stationary surface waves (Contrary to typical paradigm)



Published in Nature Comm. (Archer+, 2021) with a NASA story