Kozai–Lidov-driven episodic accretion as a trigger for FRB-like activity in compact triples

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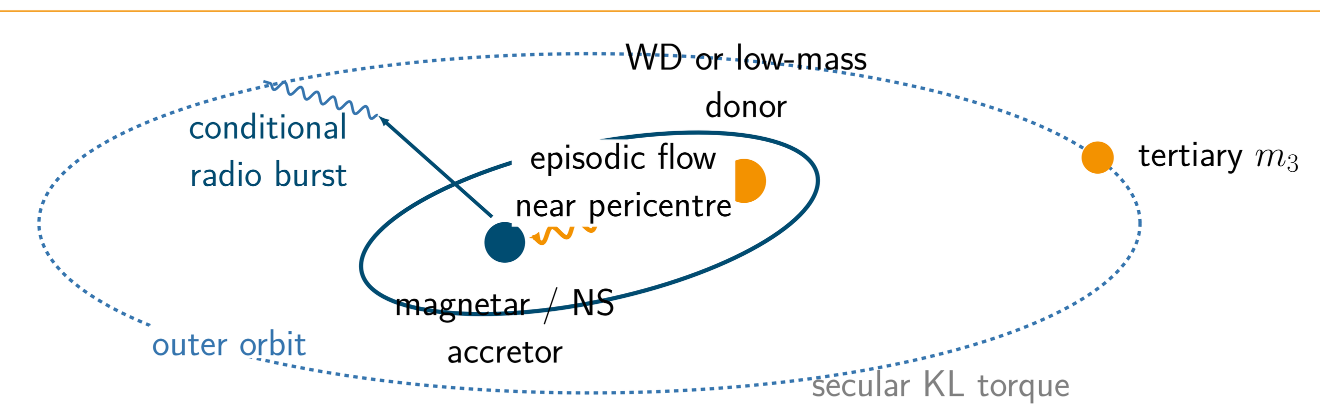
The question

Can a stable compact triple repeatedly enter a short-lived interaction state that supplies an FRB-like trigger, avoids rapid destruction and remains transparent to radio emission?

KL is the external clock — not the coherent-emission mechanism.

A dynamical route to episodic accretion



KL torque → $e_{\rm in}\uparrow$ $r_{\rm p}\downarrow$ → pericentre interaction → accretion or plasma injection → FRB-like trigger *if viable*

$$r_{\rm p} = a_{\rm in}(1-e_{\rm in}), \qquad t_{\rm KL} \simeq C_{\rm KL}\frac{m_{12}+m_3}{m_3}\frac{P_{\rm out}^2}{P_{\rm in}}(1-e_{\rm out}^2)^{3/2}$$

The diagram is schematic and not to scale. The final causal arrow requires both an operative coherent process and a radio-transparent path.

Three nested clocks

milliseconds	$P_{\rm in}$	$t_{\rm KL}$
coherent emission	pericentre opportunities	activity seasons

increasing timescale →

The secular cycle opens an activity season; successive inner orbits provide interaction opportunities; local plasma physics sets the millisecond burst. **The burst duration is neither an accretion nor a KL timescale.**

The first physical target

Primary branch: magnetar/NS + white dwarf or low-mass donor, perturbed by a tertiary. It combines a deep potential well, an anchored magnetosphere and a natural route to pericentre-fed interaction.

NS–NS, NS–BH, magnetic-WD and BH branches remain informative extensions, but each requires a distinct transfer history and radiative closure. Compact objects are therefore not treated as interchangeable.

The decisive deliverable

The first result will be a parameter-space viability map.

Empty map	**Non-empty map**
Compact KL triples are strongly constrained as repeatable FRB-like triggers.	Surviving systems generate quantitative timing, plasma and X-ray predictions.

Either outcome creates a falsifiable bridge between accretion-driven variability and coherent radio transients.

Viability is a conjunction, not a single condition

1. **Is the hierarchy long-lived?**
   stability screen + direct checks
2. **Can KL overcome competing precession?**
   $t_{\rm KL}$ versus $t_{\rm GR}, t_{\rm tide}, t_{\rm rot}$
3. **Does pericentre enter the interaction window?**
   overflow, tides or magnetosphere–flow encounter
4. **Can the system repeat?**
   avoid prompt disruption, merger or circularisation
5. **Which flow regime applies?**
   $r_{\rm m}$ versus $r_{\rm co}$ and $r_{\rm LC}$
6. **Can the trigger supply the radio energy?**
   efficiency and beaming kept explicit
7. **Can the burst escape?**
   plasma frequency, free–free absorption, induced scattering

A staged research programme

I Conservative semi-analytical screening → **II** Impulsive transfer + magnetospheric closure → **III** Direct integration near thresholds → **IV** Forward-modelled radio/X-ray observables

Each stage passes a smaller, physically admissible set to the next. Direct three-body and hydrodynamical/MHD calculations are reserved for points that survive conservative screening, making the programme computationally controlled and reproducible.

If viable, the channel makes discriminating predictions

Prediction	Measurement	Outcome that would disfavour
Nested activity windows	Multi-epoch timing with cadence-aware nulls	No reproducible window or no surviving orbital solution
Phase-linked local plasma	Joint DM–RM–scattering analysis by phase	Well-sampled variations remain uncorrelated with the predicted phase
Accretion-compatible X-rays	Simultaneous searches and phase-targeted ON/OFF monitoring	Limits below the minimum unavoidable flux for every surviving regime
Secular drift	Evolution of phase, duration and duty cycle	Drift incompatible with the coupled orbital/transfer solutions

No single signature is unique. The discriminant is their **phase-coherent combination**, evaluated prospectively and against isolated-magnetar, simple-binary, absorption, precession and stochastic rivals.

Radio–X-ray testing

Detection path

Prompt coincidence search; spectra and timing to distinguish surface accretion, low-level accretion, propeller-like expulsion and magnetar outburst states.

Non-detection path

A null result is informative only if the simultaneous limit falls below the model's minimum unavoidable flux after absorption, duration and beaming are included.

eXTP-class timing, spectroscopy and polarimetry provide the high-energy bridge; polarimetry is most realistic for bright Galactic analogues or sustained outbursts.

Selected references

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Research anchor: FAPESP-approved INPE programme and doctoral plan.