

Thorn for analysing tilted accretion disks

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Tilted Disks: Motivation and previous work

- Pioneering work in this field by *Fragile et al (2005,2006)* who have analysed tilted disks in the Cowling (fixed background spacetime) approximation.
- No reason to expect that \mathbf{S}_{BH} is aligned with the orbital plane of the NS-BH merger.
- Perform simulations with spacetime evolution to investigate effects of BH tilt to BH+torus evolution.
- Computationally cheaper (due to symmetries) to consider \mathbf{S}_{BH} and \mathbf{L}_{disk} aligned.

Analysis of Twist and Tilt

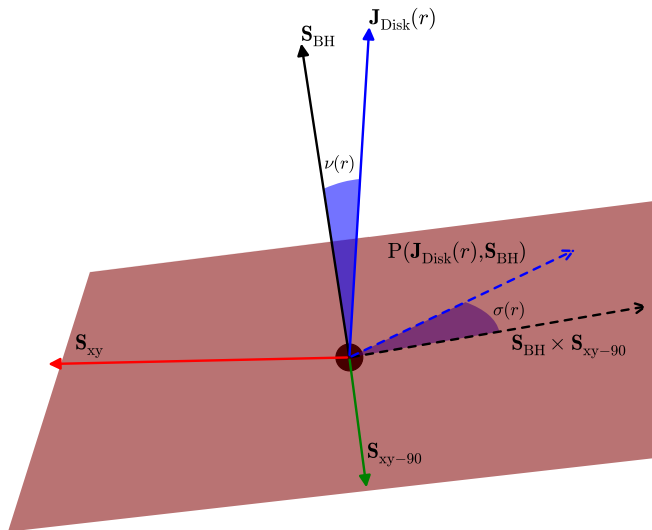
- We analyse the **response** of the disk to the **tilted BH** by **two quantities**:
- The **twist**: $\sigma(r) = \angle(\mathbf{S}_{\text{BH}} \times \mathbf{S}_{\text{xy}-90}, P(\mathbf{J}_{\text{Disk}}(r), \mathbf{S}_{\text{BH}}))$, where

$$P(\mathbf{a}, \mathbf{b}) = \mathbf{a} - \frac{\mathbf{a} \cdot \mathbf{b}}{|\mathbf{b}|^2} \mathbf{b}, \quad (1)$$

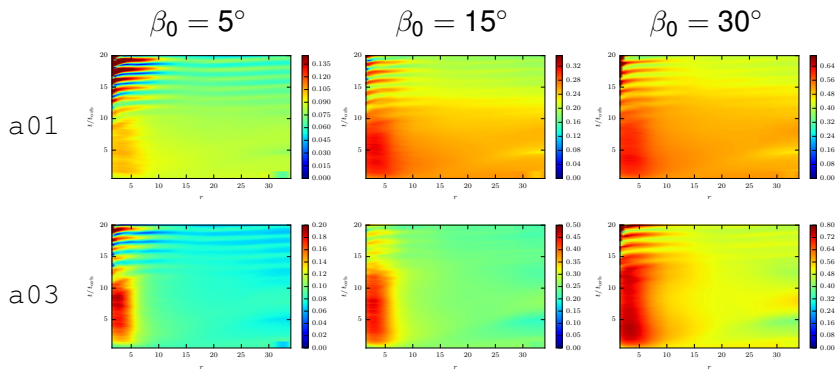
is the projection of vector \mathbf{a} onto the plane with normal \mathbf{b} .

- and **tilt**: $\nu(r) = \angle(\mathbf{S}_{\text{BH}}, \mathbf{J}_{\text{Disk}}(r))$
- The disk is said to become twisted (warped), if $\sigma(r)$ ($\nu(r)$) **vary** with r

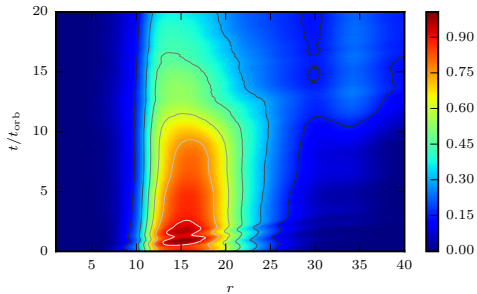
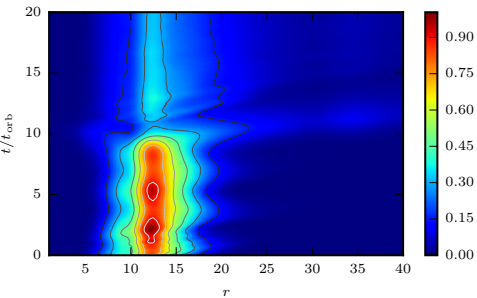
Analysis of Twist and Tilt II



T-r diagrams of complete tilt evolution NC1



Angular momentum transport for C1Ba00 and NC1a00



The End

Thank you for your attention!

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