

# MINERVA FOUNDATION

## *Columbia Lectures on the Stability of Kerr*

Professor Sergiu Klainerman (Princeton University)



### The main goals of these lectures are:

1. Provide a comprehensive introduction to the proof of the nonlinear stability of slowly rotating Kerr black holes established recently in the sequence of works [Kl-Sz:Kerr], [GKS-2022],[Kl-Sz:GCM1],[Kl-Sz:GCM2] and [Shen], and briefed in [Kl-Sz:review].
2. Discuss the geometric formalism based on non-integrable null horizontal structures used in these works. Derive the main Teukolsky and generalized Regge-Wheeler equations. These follow the material 1 of Part 1 in [GKS-2022].
3. Discuss the proof of the basic hyperbolic estimates, Morawetz and  $r_p$ -weighted, following Part 2 of [GKS-2022].
4. Discuss open problems related to these topics.

### References

- [Giorgi] E. Giorgi, The linear stability of Reissner-Nordstrom spacetime for small charge, *Ann. PDE* 6, 8 (2020).
- [GKS-2022] E. Giorgi, S. Klainerman and J. Szeftel, Wave equations estimates and the nonlinear stability of slowly rotating Kerr black holes, arXiv:2205.14808.
- [Kl-Sz:GCM1] S. Klainerman and J. Szeftel, Construction of GCM spheres in perturbations of Kerr, *Ann. PDE*, 8, Art. 17, 153 pp., 2022.
- [Kl-Sz:GCM2] S. Klainerman and J. Szeftel, Effective results in uniformization and intrinsic GCM spheres in perturbations of Kerr, *Ann. PDE*, 8, Art. 18, 89 pp., 2022.
- [Kl-Sz:Kerr] S. Klainerman and J. Szeftel, Kerr stability for small angular momentum, *Pure and Appl. Math. Quarterly (PAMQ)*, Volume 19(2023), 3, pp. 791-1678,
- [Kl-Sz:review] S. Klainerman and J. Szeftel, Brief introduction to the stability of Kerr, arXiv:2210.14400, to appear in *PAMQ*.
- [Shen] D. Shen, Construction of GCM hypersurfaces in perturbations of Kerr, arXiv:2205.12336.

**First lecture: Wednesday, September 6, 2023**

**Meeting on Wednesdays at 2:45pm**

**Room 507, Mathematics Hall**



**COLUMBIA UNIVERSITY**

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