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A Talk at the 2nd ISNMP Conference

Bad Ems, 28 June to 4 July 2026

Open Problems Session:

Speaker: Frank Nijhoff (University of Leeds, UK & Shanghai University, PR China)

Title: *Do Integrable Systems have a future?*

Abstract: When it comes to open problems in the area of integrable systems the suggestion is sometimes given that the subject is at the end of its life and that virtually everything has been solved. I am of the opposite conviction, namely that, in spite of the enormous amount of progress in many areas, and the impressive impact the subject has had on the development of modern mathematics (e.g. quantum groups, knot theory, inverse analysis, difference geometry, algebraic geometry, cluster algebras, numerical analysis and mathematical physics in general) we are still in a sense 'scratching the surface' and profound questions remain unaddressed, even ignored. Solving these questions may not only fill open gaps in the area, but may also lead to deeper understanding as well as perhaps open new areas of mathematics.

Without giving away clues here already (I don't want to destroy the suspense by revealing the 'who's dunnits' in advance) I will mention a few concrete problems in three areas:

1. Painlevé type systems and reductions;
2. integrable lattice equations and their solutions;
3. integrable quantum systems and Lagrangian structures.

Furthermore, if time allows, I will try and develop ideas on where I see the subject of integrable systems, and its potential impact on foundational mathematical physics, could, or indeed should, be going, and the interplay between classical & quantum as well as the corresponding notions of space-time.