LTCC Advanced Course

- Title: **Introduction to spectral theory of Hankel and Toeplitz operators**
- Basic Details:
  - Core Audience: PhD students and researchers with interests in spectral theory; Banach spaces of analytic functions; functional analysis.
  - Course Format: extended (10 hours at 2 hours per week).
- Course Description:
  - Keywords: Hankel operators; Toeplitz operators; Hardy spaces; Bergman spaces; compact operators.
  - Syllabus:

    1. Introduction. Hardy space, Bergman spaces: basic facts. Spectral theory of multiplication operators on Hardy and Bergman spaces. Definitions of basic objects: Toeplitz operators on Hardy space, Toeplitz operators on Bergman space, Hankel operators (on Hardy space).

    2. Toeplitz operators on Hardy space. Uniqueness of the symbol. Characterisation of the norm. Non-compactness. Background facts on Fredholm operators. The essential spectrum and the index of Toplitz operators.

    3. Toeplitz operators on Bergman space. Uniqueness of the symbol. Boundedness and the norm. Compactness (for continuous symbols). The trace class property.

    4. Hankel operators on Hardy space. Non-uniqueness of the symbol. The norm: Nehari's theorem. Compactness: Hartman's theorem. Finite rank operators: Kronecker's theorem.
  - Recommended reading:

    V.V.Peller, *Hankel operators and their applications,* Springer 2003.

    K.Zhu, *Operator theory in function spaces,* AMS 2007.

    R.A.Martinez-Avendano, P.Rosenthal, *An introduction to operators on the Hardy-Hilbert space,* Springer, 2010.

    J.R.Partington, *An introduction to Hankel operators,* Cambridge University Press, 1988.

    J.R.Partington, *Banach spaces of analytic functions,* lecture notes, available online, click here
  - Additional Optional reading:

    A.Bottcher, B.Silbermann, Analysis of Toeplitz operators, Springer, 2010
  - Prerequisites:

    A course in functional analysis.
- Format:
  - No. of discussion/problem sheets: 4 (to be confirmed).
  - Electronic lecture notes: brief notes with links to relevant chapters in the recommended literature will be provided.
  - Necessary support facilities: None
  - Proposed timing: Early spring (January-February).
  - Lecture/tutorial split: 10/0 hours.
- Lecturer Details:
  - Lecturer: Dr Alexander Pushnitski
  - Lecturer home institution: King's College London
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  - Lecturer telephone number: 0207 848 1167