Two applications of the Bergman space techniques

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It happens often in mathematics that the ideas and methods from one area lead to the progress in another, quite different area. The aim of the mini-course is to present two examples of such a situation, where the use of Bergman space techniques gives new results in other areas of analysis.

Our first subject is the biharmonic maximum principle on hyperbolic surfaces. It is well known that this principle holds for the disk but it fails for a generic planar domain. It turns out that it holds also for Hele-Shaw disks on hyperbolic surfaces and the proof of this fact reduces to the analysis of reproducing kernels in appropriate weighted Bergman spaces in the unit disk.

The second topic is integral estimates of derivatives of conformal mappings. We shall discuss a recent progress in this area obtained by combining classical area principles for univalent functions with the techniques of weighted Bergman spaces in the bidisk.