HIGGS BUNDLES, HITCHIN FIBRATIONS AND SOME RELATED PROBLEMS

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The moduli space of Higgs bundles on a projective curve has many applications in geometry and Langlands program. It plays an important role in the study of representation of the fundamental group of the curve. Ngo observed that for curves defined over finite fields, the adelic description of the stack of Higgs bundles on the curve is related to spaces occurring in the study of the Langlands-Shelstad trace formula and used it to prove the Langlands-Shelstad fundamental lemma. (Roughly speaking, Ngo's proof is the combination of a detailed study of the geometry of the Hitchin fibration - the morphism from the moduli space of Higgs bundles to characteristic polynomials, and that of the Beilinson-Bernstein-Deligne decompostion theorem in this special context). In this talk, I would like to convince audiences the important of the moduli space of Higgs bundles and to introduce some related problems which I am interested in.