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Valuation theory, Riemann varieties and birational geometry

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In order to define the relevant classes of singularities needed in Mori theory such as terminal and canonical singularities, all one needs is to define valuations of rational top differential forms for arbitrary discrete algebraic valuation rings. We show how to extend this to arbitrary valuations of the function field, by first giving an explicit formula for Abhyankar places and then extend it to arbitrary places by means of density and continouity arguements. We are thus able to define log discrepancies of a log pair for arbitrary valuations. Moreover, we find even for divisorial discrete rank one valuations an explicit formula for the valuation of a top differential form, that makes it in principle possible to calculate the discrepancy.
As applications we investigate the
-locus of the log pair , i.e. the set of all valuations for which the log discrepancy is .
We can generalize the notion of log canonical centers and can prove a generalized adjunction formula for Abhyankar lc centers. If there is enough time, we will consider sheaves on the Riemann variety of the function field associated to -divisors in the sence of Shokurov and investigate their coherence and local freeness properties. We will give a simple criterion for a monotonous sequence of
-Cartier divisors to become stationary which is a basic question of birational geometry arising in connection with the finite generation of a divisorial algebra such as the flipping algebra of a flipping contraction or the log canonical algebra of a log pair , and even in connection with the question whether a sequence of log flips terminates.

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