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Complex differential equations with single-valued solutions

We will talk about recent work in collaboration with Julio Rebelo dealing with semicomplete meromorphic vector fields on complex surfaces, that is, vector fields whose solutions are single-valued in restriction to the open set where the vector field is holomorphic. We will show that, up to a birational transformation, a compact connected component of the divisor of poles is either a rational or elliptic curve of vanishing self-intersection or has the combinatorics of a singular fiber of an elliptic fibration. This implies that up to a birational transformation, a semicomplete meromorphic vector field on a compact complex projective surface is either holomorphic, has a first integral or preserves a fibration. This extends to semicomplete polynomial vector fields in \mathbb{C}^2 the results established by Brunella for complete ones.