## ELLIPTIC FIBRATIONS ON THE RATIONAL ELLIPTIC SURFACE

## Miklós Eper, Szilárd Szabó

Budapest University of Technology and Economics, Budapest, Hungary

In 1963 K. KODAIRA [2] gave the complete list of singular fibers, which can occur in elliptic fibrations. The question, which combination of these singular fibers are possible on the rational elliptic surface, have been answered by U. PERSSON and R. MIRANDA [3] in 1990. An interesting feature of this topic is, that elliptic fibrations on the rational elliptic surface can be considered from algebraic geometric point of view as well. Elliptic fibrations with certain types of singular fibers can be constructed via blowing up pencils on the rational elliptic surface.

All fibrations in our studies arise from blow up of pencils, and this is the process we will use to construct such fibrations. These constructions of elliptic fibrations with certain types of singular fibers have been described in the papers, provided by A. STIP-SICZ, SZ. SZABÓ and P. IVANICS, except the case of fibration with singular fiber  $I_1^*$ . The main result of our investigation is the explicit, algebraic geometric construction of the 13 possible configurations of elliptic fibrations with  $I_1^*$  fiber. These constructions on the Hirzebruch surface, and the pencils from which they arise, have not been described yet.

We introduce the most important definitions and theorems related to elliptic fibrations on the rational surface, the main literature used here is the book *Principles* of algebraic geometry by P. GRIFFITHS and J. HARRIS [1]. We also describe, which combinations can occure with an  $I_1^*$  type fiber, based on the paper of A. STIPSICZ, Z. SZABÓ, and Á. SZILÁRD [4]. Finally, we present our results, i.e. the constructions of rational elliptic surfaces, containing the 13 possible singular fiber configurations, by choosing the right pencils, and supporting our calculations with figures, illustrating the process.

- [1] GRIFFITHS, P., HARRIS J. Principles of Algebraic Geomet-ry, Wiley., (1994)
- [2] KODAIRA, K. On compact analytic surfaces: II, Ann. Math., 77, (1963), 563-626.
- [3] MIRANDA, R. Persson's list of singular fibers for a rational elliptic surface, Math. Z., 205, (1990), 191-211.
- [4] STIPSICZ, A.I., SZABÓ, Z., SZILÁRD A. Singular fibers in elliptic fibrations on the rational elliptic surface, *Periodica Mathematica Hungarica*, (2007), 54:137–162