Wednesday	Talks	Thursday	Talks
10:15-10:45	History and introduction	10:15-11:15	Seifert fibre spaces, pt.1
11:00-12:00	Geometry of $\mathbb{R}^2$ and $\mathbb{S}^2$	11:30-12:30	Seifert fibre spaces, pt.2
12:00-13:30	**Lunch break**	12:30-14:00	**Lunch break**
13:30-14:30	Geometry of $\mathbb{H}^2$	14:00-15:00	Geometry of $\mathbb{R}^3$ and $\mathbb{H}^3$
14:30-15:00	**Coffee break**	15:00-15:30	**Coffee break**
15:00-16:00	2-dimensional orbifolds	15:30-16:30	Geometry of $\mathbb{S}^3$, $\mathbb{S}^2 \times \mathbb{R}$ and $\mathbb{H}^2 \times \mathbb{R}$
16:10-16:50	Discussion and exercises	16:40- 17:20	Discussion and exercises

Friday	Talks
10:15-11:15	Geometry of $\widetilde{SL_2}(\mathbb{R}), Nil$ and Sol
11:30-12:30	Classfication of 3-dimensional geometries, pt.1
12:30-14:00	**Lunch break**
14:00-15:00	Classification of 3-dimensional geometries, pt.2
15:00-15:30	**Coffee break**
15:30-16:00	Outlook
16:10- 16:50	Discussion and exercises

The Geometries of 3-Manifolds

20.06.2017

0 History and Introduction (pp.401-405)

- Give some motivation and a basic overview for the seminar. In particular, explain what exactly is meant by the term "geometric structure".

1 The 2-dimensional geometries (pp.405-428)

1.1 Euclidean and spherical geometry (pp.405-413) [Annette]

- Riemannian metrics and other inhertied metrics, discrete subgroups of $\mathbf{Isom}(\mathbb{R}^2)$ and $\mathbf{Isom}(\mathbb{S}^2)$ (with and without fixed pts), types of singularities (cone points, reflector lines, corner reflections), triangle groups, tilings and fundamental regions, classification of discrete subgroups.

1.2 Hyperbolic geometry (pp.413-421) [Pascal]

- The embedding problem, the Poincare model for $\mathbb{H}^2$, geodesics and triangles, discrete subgroups of $\mathbf{Isom}(\mathbb{H}^2)$ (with and without fixed pts).

1.3 2-Dimensional orbifolds (pp.421-428) [Hartwig]

- Singularities, orbifold coverings/orbifold fundamental group, "Good" vs. "bad" orbifolds, the Uniformization Theorem for orbifolds, The Euler Number of orbifolds and the Riemann-Hurwitz formula.

2 The basic theory of Seifert fibre spaces (pp.428-441)

- (pp.428-435 **[Irene]**) Definition and basic examples (Lens spaces), isomorphism of vs. homemorphism of SFS , Fibered solid tori and basic orbit invariants, the underlying orbifold, SFS as "bundles" over 2-orbifolds, the universal covers of SFS (Lemma 3.1), the orbifold exact sequence (Lemma 3.2), SFS as circle bundles $\nu : M \to \Sigma$ over closed surfaces Σ and the obstruction invariant $b(\nu)$, a degree formula for oriented circle bundles (Lemma 3.5).
- (pp.435-441 **[Johannes]**) The Euler number $e(\nu)$ for SFS as "bundles" $\nu : M \to \Sigma$ over 2-orbifolds, a degree forumla (Theorem 3.6) for e, the connection between b and e, consequence of a vanishing Euler number (Lemma 3.7), homeomorphism vs. isomorphism of SFS (Theorems 3.8 and 3.9).

3 The eight 3-dimensional geometries (pp.441-472)

3.1 Introduction, the geometry of $\mathbb{R}^3$ and basic properties of $\mathbb{H}^3$ (pp.441-449) [Christoph]

3.2 The geometry of $\mathbb{S}^3$, $\mathbb{S}^2 \times \mathbb{R}$ and $\mathbb{H}^2 \times \mathbb{R}$ (pp.449-462) [Jasmin]

3.3 The geometry of the Lie groups $\tilde{SL_2}(\mathbb{R})$, Nil and Sol (pp.462-472) [Florian]

4 The Classification of the 3-dimensional geometries (pp.473-482)

- Classification of maximal geometries (Theorem 5.1), Uniqueness of geometric structure (Theorem 5.2), Geometries on SFS (Theorem 5.3), the affect of gluing maps on geometric structures (Theorem 5.4 and 5.5).

5 Outroduction: The Geometrization conjecture and associated conjectures (pp.482-end)

- Here, one should get a small overview of current developments and give a list of those conjectures that have been solved by now.

References

[1] Peter Scott, **The geometries of 3-manifolds**, Bull. London Math. Soc, 15 (1983), 401-487