

Rogers 2018 Notes

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1 Week 1

1.1 Day 1

1.1.1 Talked about:

Some goals of research:

- Goal 1
 - 17 crystallographic groups [TSOT, Thurston's Notes] and associated 2-orbifolds
 - 14 spherical symmetry groups and associated 2 orbifolds
 - Generally, see what orbifolds are and relate group to topological object.
- Goal 2
 - Spectral question for 2-orbifold, what can we hear? (eigenvalue spectrum of Laplace op. on object), (applications)
- Goal 3
 - Identify a pleasant class of 3-orbifolds to study
 - * prime 3-orbifold
 - * not prime
 - * Spherical
- Goal 4: Repeat Goal 2 but for dim 3.

A group action of G on a manifold M . This forms a quotient object M/G , which can be a manifold or orbifold. (We did example of $G = \mathbb{Z} \times \mathbb{Z}$ and $M = \mathbb{R}^2$). Some questions regarding the quotient of a manifold are: What are the orbits? What is the fundamental domain? What is the gluing diagram?

1.1.2 TODO

M/G quotient object if $M = \mathbb{R}^2$ and $G = \{\mathbb{Z} \times \mathbb{Z}, R_{180}\}$

1.2 Day 2

1.2.1 Did

Quotient object hw

1.2.2 Talked about

Homework and first steps into Algebra

1.2.3 TODO

- Read Dummit-Foote Chapter 1 on dihedral groups, cyclic groups, definition of a group.
- Homework on groups: Looking into $G = \{r_x, r_y, R_{180}, \mathbb{Z} \times \mathbb{Z}\}$ and $M = \mathbb{E}$

1.3 Day 3

1.3.1 Did

hw on groups

1.3.2 Talked About

- Groups in general. (How many different multiplication table combinations of e, a, b, c, \dots can you have?)
- Definition of manifolds and orbifolds. Orbifolds can have nasty complications...

1.3.3 TODO

- DGGW example 2.15
- DGGW example 2.16 (3D orbifold)

1.4 Day 4

1.4.1 Did

Both DGGW examples

1.4.2 Talked about

The examples and the DGGW paper.

1.4.3 TODO

- pg. 44 Dummit-Foote, #4 and #19.
- Gauss-Bonnet Theorem in shape of space
- Find all isotrop groups for $*2222$

1.5 Day 5

1.5.1 Did

Gauss-Bonnet Theorem and isotrop groups. Perhaps you can find fundamental domain from isotropy groups of points?

1.5.2 Talked about

- Gauss-Bonnet Theorem
- Curvature

1.5.3 TODO

Still pg. 44 Dummit-Foote, #4 and #19.

2 Week 2

2.1 Day 6

2.1.1 Did

Dummit-Foote pg. 44 problem 4.

2.1.2 Talked About

Addressed some basic set theory, including the formal definition of an equivalence relation to work towards problem 19. Began our discussion on the heat kernel!

2.1.3 TODO

- In $(;2,2,2,2)$, Identify the singular strata, their isotropy groups, sort out which of those are “primary” singular strata.
- Same question for xyz-rotation orbifold.
- Perhaps look at Burstall’s differential geometry crash course notes

2.2 Day 7

2.2.1 Did

Read the important sections of the DGGW paper thoroughly up to section 2.14.

2.2.2 Talked About

Worked out the meaning of $Iso^{max}(\tilde{N})$. Talked more about the heat kernel up to the result $Tr(K) = \sum_{j=0}^{\infty} c_j t^{j/2} \sim_{t \rightarrow 0^+} I_0 + \sum_{N \in S(O)} \frac{I_N}{|Iso(N)|}$.

2.2.3 TODO

- Work out primary strata for some examples
- Perhaps look at asymptotic expansion notes

2.3 Day 8

2.3.1 Did

- Looked into differential geometry crash course notes, but they are a bit too formal to understand.