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Discrete subgroup acting on coset space

Let G be a locally compact Hausdorff topological space, $K \leq G$ be a compact and $\Gamma < G$ be a discrete subgroup. Then orbits of

$$\Gamma \curvearrowright G/K$$

are discrete.

Consider $[i] \in G/K$ and let $i \in G$ has a precompact onb U . Then UK is a onb of $[i]$.

- For $\gamma \in \Gamma$ then

$$\gamma(K) \cap UK \neq \emptyset \iff \gamma K \cap U \neq \emptyset$$

- $\{\gamma \in \Gamma | \gamma K \cap U \neq \emptyset\} = \{\gamma \in \Gamma | \gamma \in UK \neq \emptyset\} \subseteq \Gamma \cap \overline{UK}$

which is finite, so

$$\{\gamma \in \Gamma | \gamma K \cap U \neq \emptyset\} = \{\gamma_1, \dots, \gamma_n\}$$

- Choose $V \subseteq U$ such that

$$V \cap \left(\bigcap_{1 \leq i \leq n, \gamma_i K \neq K} \gamma_i K \right)$$

- Then V

Proposition: Let G be a locally compact Hausdorff topological space, $K \leq G$ be a compact and $\Gamma < G$ be a closed subgroup such that $\Gamma \cap K$ is finite and Γ -orbits on G/K are discrete. Then Γ is discrete.

There is a open $W \subseteq G/K$ such that $W \cap \Gamma[i] = \{[i]\}$.

- Then

$$\underbrace{\pi^{-1}(W)}_{\text{open nb of } i} \cap \Gamma K = K$$

- $$\begin{aligned} U \cap \Gamma K &\subseteq K \\ \implies U \cap \Gamma K \cap \Gamma &\subseteq \underbrace{K \cap \Gamma}_{\text{finite}} \end{aligned}$$

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