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Objects stemming from $\mathbb{R}$ -spaces of dimension 2

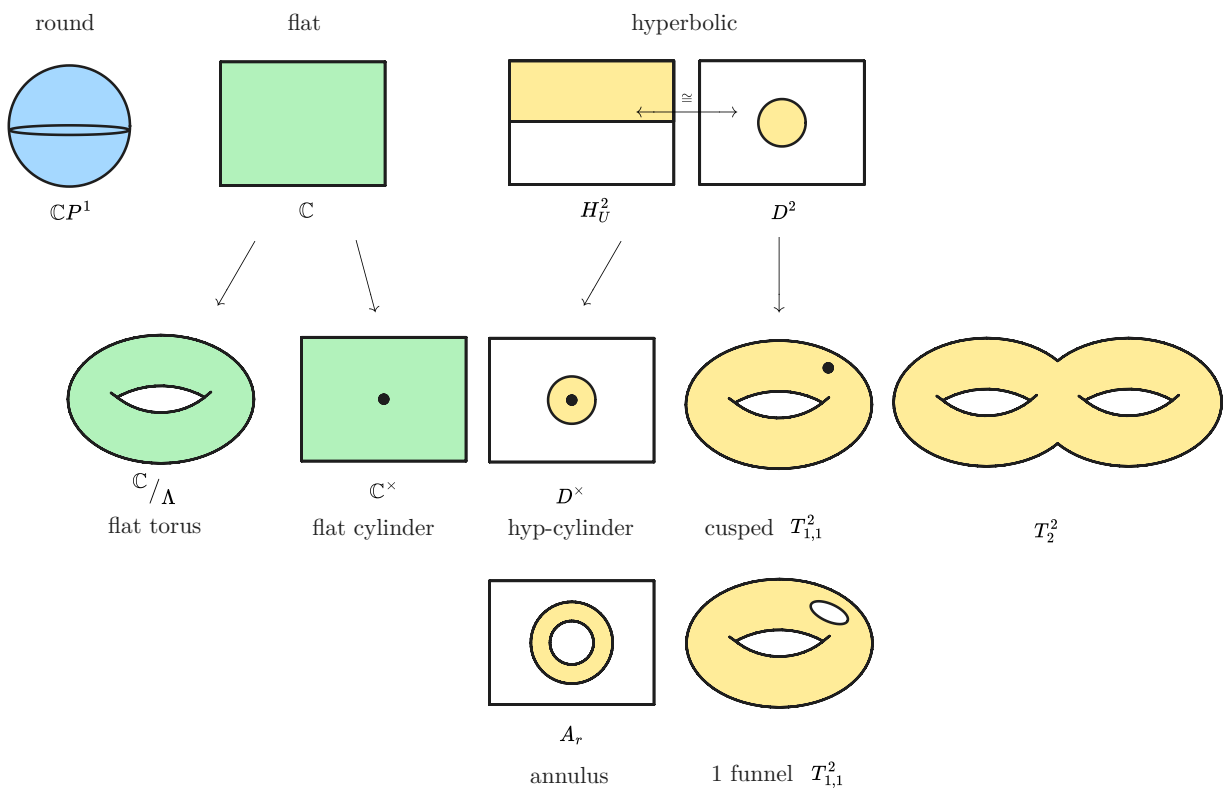
Every orientable smooth $\mathbb{R}$ -manifold of dimension 2 has a structure of a $\mathbb{C}$ -manifold of dimension 1.

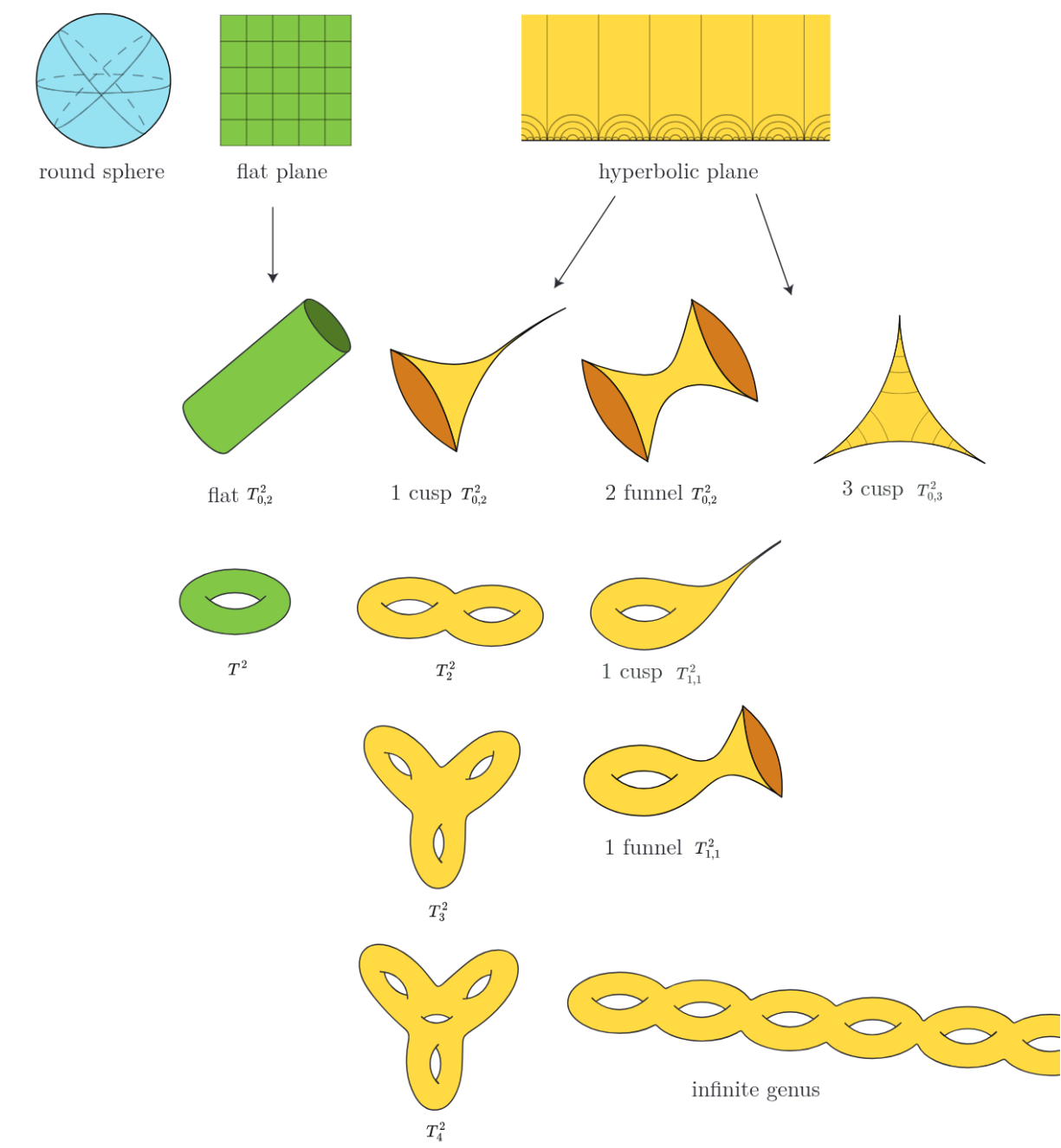
We may study the "classification" of connected, orientable smooth $\mathbb{R}$ -manifolds of dimension 2 through the "classification" of Riemann surfaces:

Definition. Connected complex $\mathbb{C}$ -manifolds of $\mathbb{C}$ -dimension 1 are called **Riemann surfaces**.

(Uniformization of simply connected Riemann surfaces) Every *non-compact simply connected* Riemann surface is biholomorphic to the complex plane $\mathbb{C}$ or the unit disk D . Every *compact simply connected* Riemann surface is biholomorphic to the Riemann sphere $\mathbb{C}P^1$

So every Riemann surface is a quotient of $\mathbb{C}P^1$ or $\mathbb{C}$ or H^2_U by a discrete subgroup of their $\text{AutMan}_{\mathbb{C}}$ group.





$\downarrow g$ $\xrightarrow{n}$	0 (T_g^2 is connected sum of g many 2-torus T^2)	1	2	3
0	<u>space.R.sphere.2</u>			
1				
2				
3				

$$\begin{array}{c} \text{Teich}(T_{g,n,k}) \\ \downarrow \\ \text{Mod}(T_{g,n,k}) \end{array} \rightarrow$$

genus	degree $g = \frac{(d-1)(d-2)}{2}$	dim of moduli of smooth curves $3g-3$	dim of moduli of smooth curves in $\mathbb{C}P^2$ $\binom{d+2}{2} - 9$	dim of moduli of hyperelliptic Riemann surfaces $2g-1$
1	3	1	1 (all)	1 (all)
2		3		3 (all)
3	4	6	6	5
4		9		7
5		12		9
6	5	15	12	11
7		18		13
8		21		15
9		24		17
10	6	27	19	19
11		30		21
12		33		23
13		36		25
14		39		27
15	7	42	27	29
16		45		31

Current note has 4 direct children and 25 total descendants.

- stem
 - Objects stemming from $\mathbb{R}$ -spaces of dimension 2
 - Riemann surfaces
 - Vector bundles on complex 1-manifolds
 - Classification of complex 1-manifold
 - Riemann's existence of holomorphic maps between compact Riemann surfaces
 - Divisors on compact Riemann surfaces
 - Fluid
 - Meromorphic differentials on Riemann surfaces
 - Holomorphic functions on a complex 1-manifold
 - Global holomorphic functions on a complex 1-manifold
 - Global algebraic functions on a complex 1-manifold
 - Non-constant holomorphic maps between Riemann surfaces locally looks like w^k and are open maps
 - Holomorphic maps of type $0 \xrightarrow{3} 0$

	• Rational maps • Hurwitz scheme • Moduli space of $\mathbb{C}$-manifolds • Meromorphic functions on a Riemann surface • Normalization of plane projective $\mathbb{C}$-curves and Riemann surfaces • Riemann surfaces defined over a number field • Hyperelliptic Riemann surfaces • T $\mathbb{C}$ • $\mathbf{Sym}^2(T^{(1,0)}X) \twoheadrightarrow X$ • Differential forms on complex 1-manifolds • Riemann surfaces with a holomorphic 1-form
	• C-analytic spaces of dimension 1 • Riemann quasiconformal surfaces • Teichmuller space of surfaces
	• Objects stemming from $PSL(2)(\mathbb{R})$ • Fuchsian groups $\Gamma <_{\mathfrak{d}} PSL(2)(\mathbb{R}) \leftrightarrow$ oriented hyperbolic 2-manifold/orbifolds $\rightarrow$ Riemann surfaces with branching signature

And it has 13 siblings.

• stem	• $GL(n)$ • $GL(n)(\mathbb{C})$ • $GL(n)(\mathbb{R})$ • Knots • Objects stemming from spaces over $\mathbb{Q}$ • Objects stemming from $\mathbb{R}$-spaces of dimension 2 • Objects stemming from $\mathbb{R}$-spaces of dimension 3 • Objects stemming from $\mathbb{R}$-spaces of dimension 4 • subobjects of and functions on $\mathbb{R}^n, S^n, \mathbb{C}^n$ and its quotients $\Gamma \backslash \mathbb{R}^n, \Gamma \backslash \mathbb{C}^n$ • Convex sets in $\mathbb{R}^n, \mathbb{R}H^n$ or S^n • Objects stemming from $\mathbb{R}$-semi-simple/reductive Lie groups • Objects stemming from $PSL(2)(\mathbb{C})$ • Objects stemming from $PSL(2)(\mathbb{R})$
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