Representation of musical notation in Haskell

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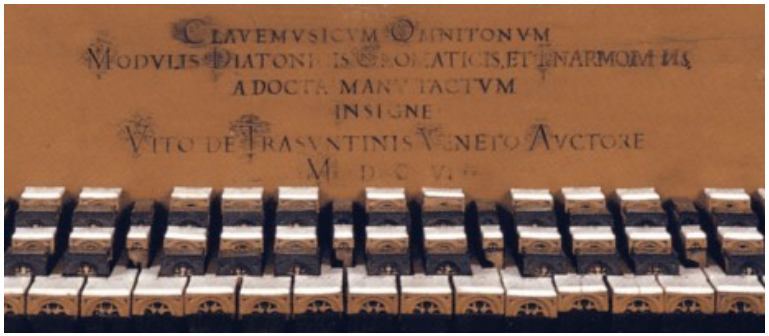
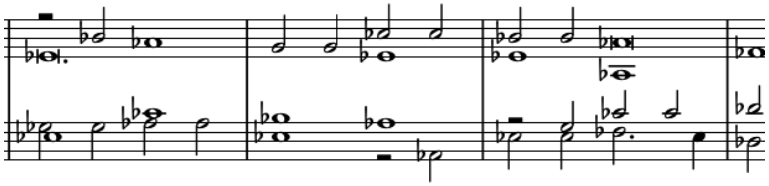
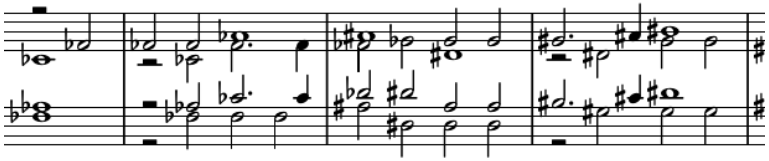
Motivation



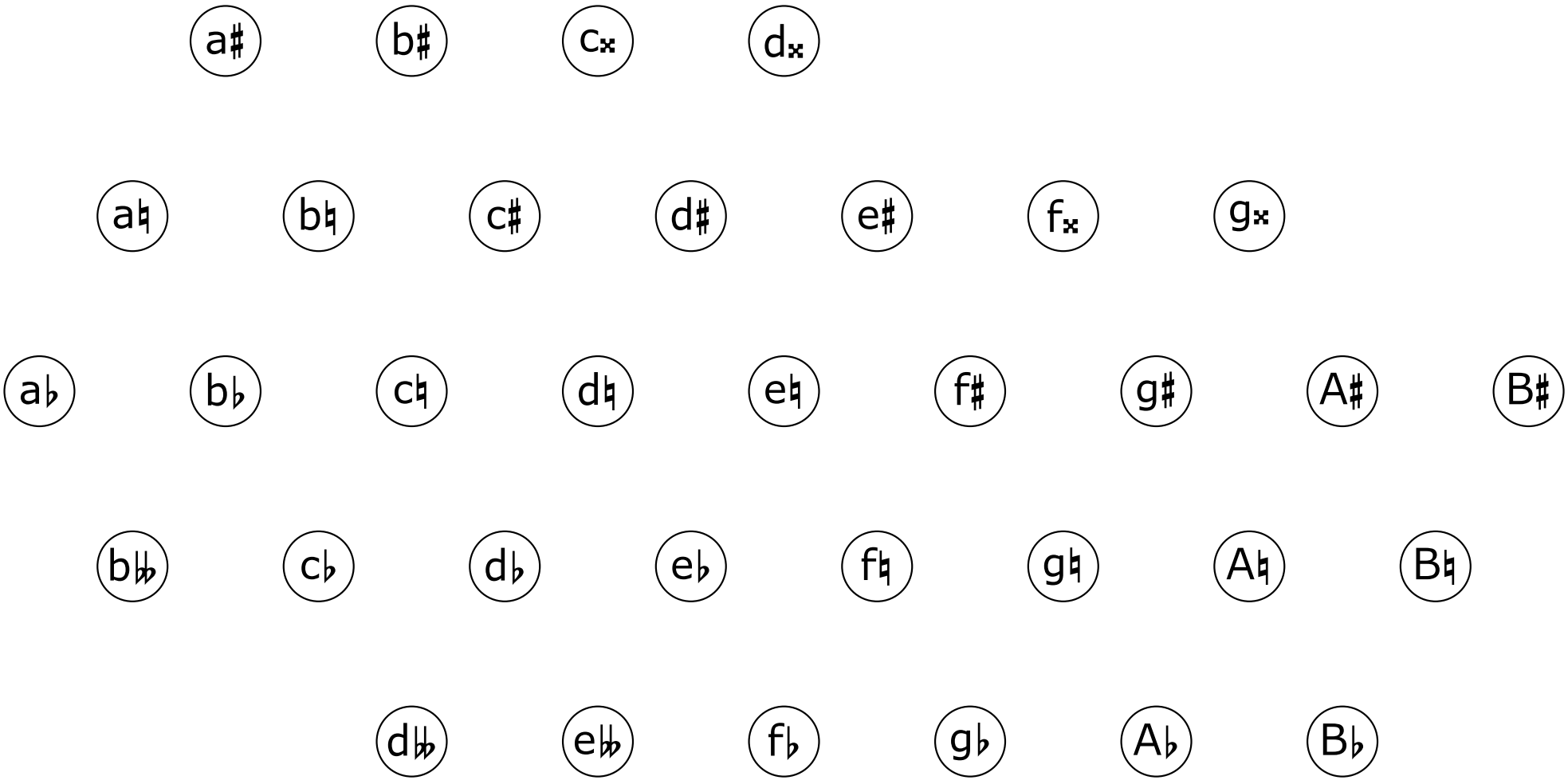




Theory

- (Notated) musical pitches are the points on a lattice
- (Notated) musical intervals connect the points, forming a ‘free Abelian group’ with two generators

Theory



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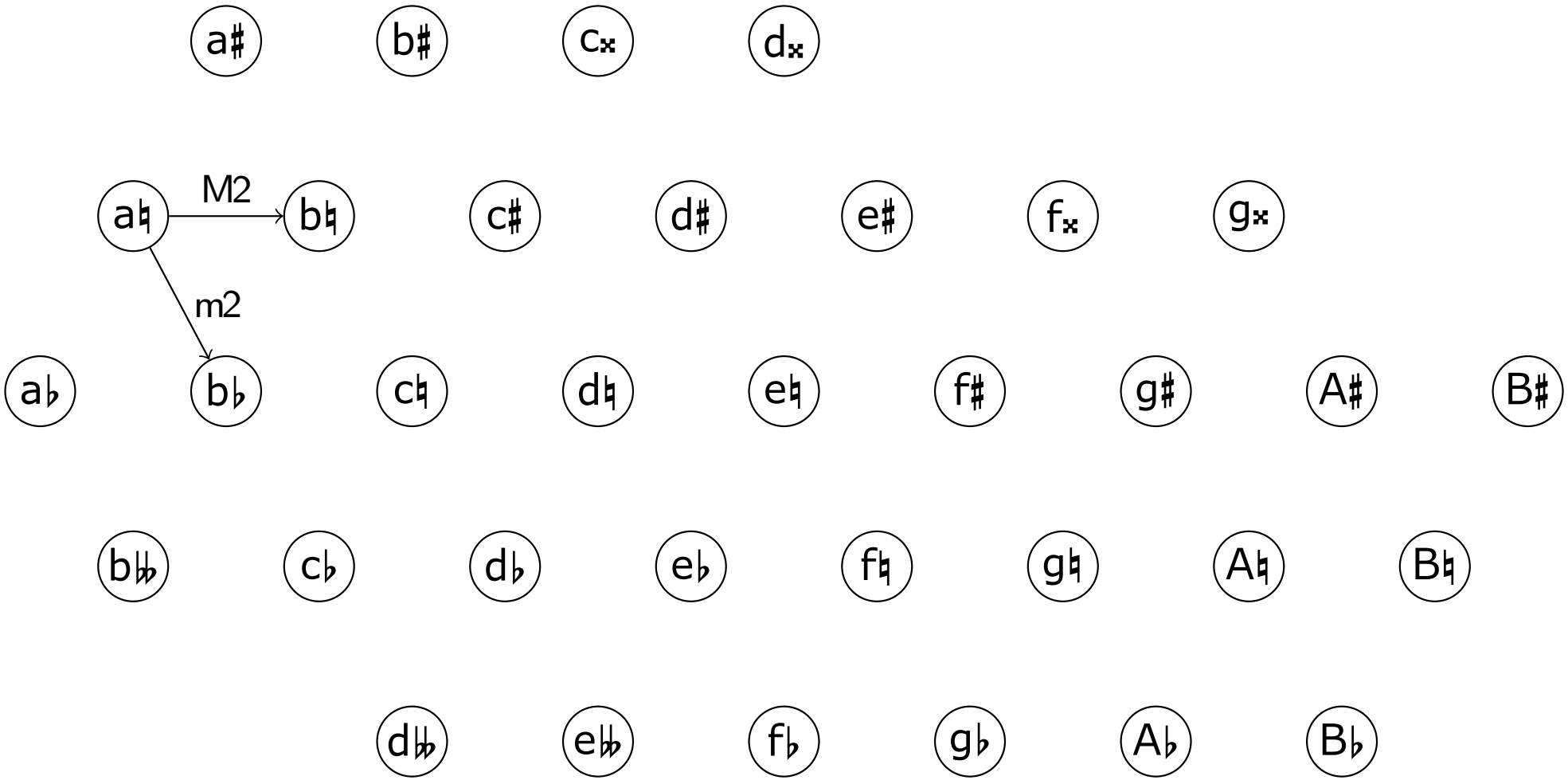

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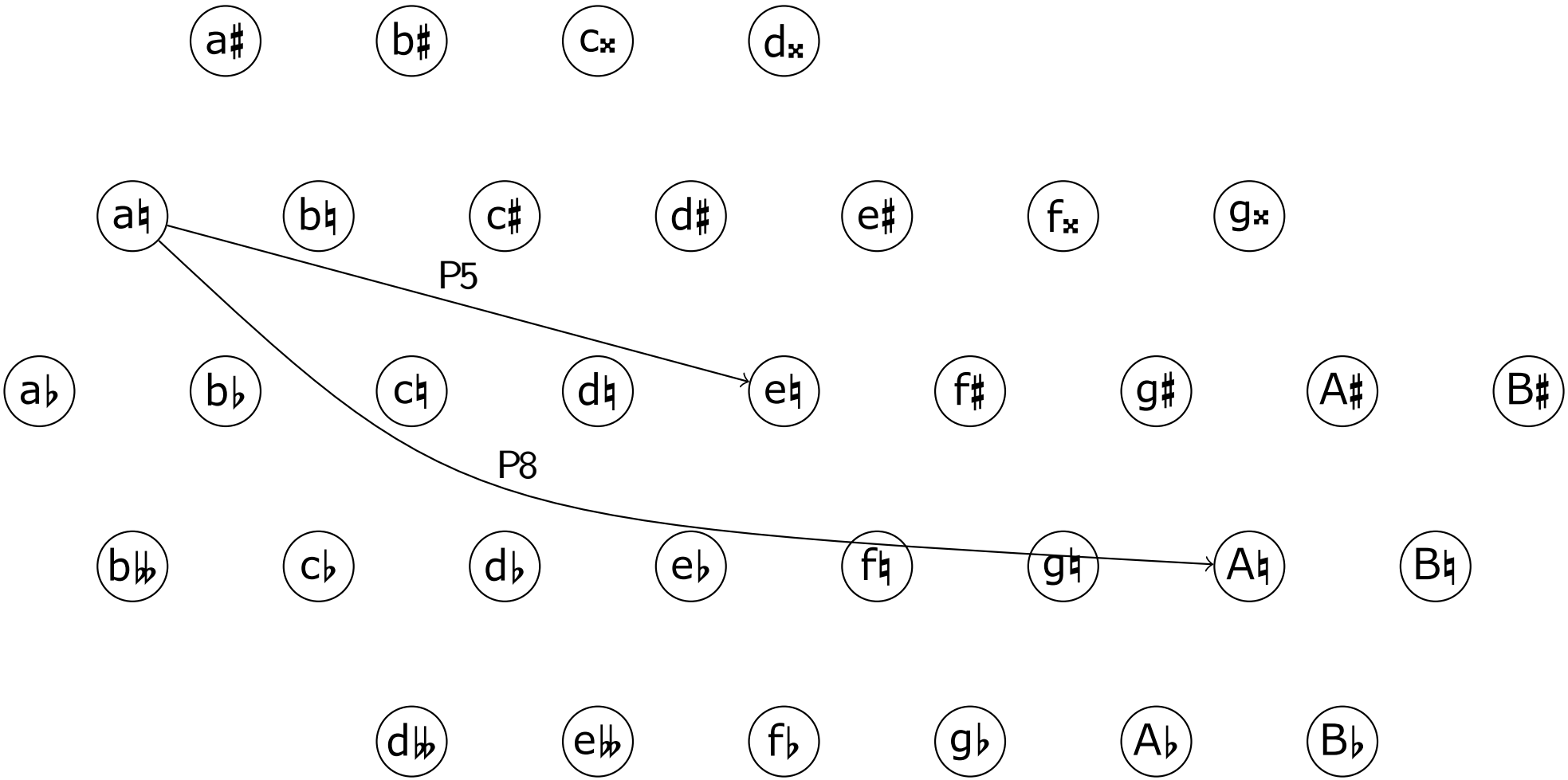

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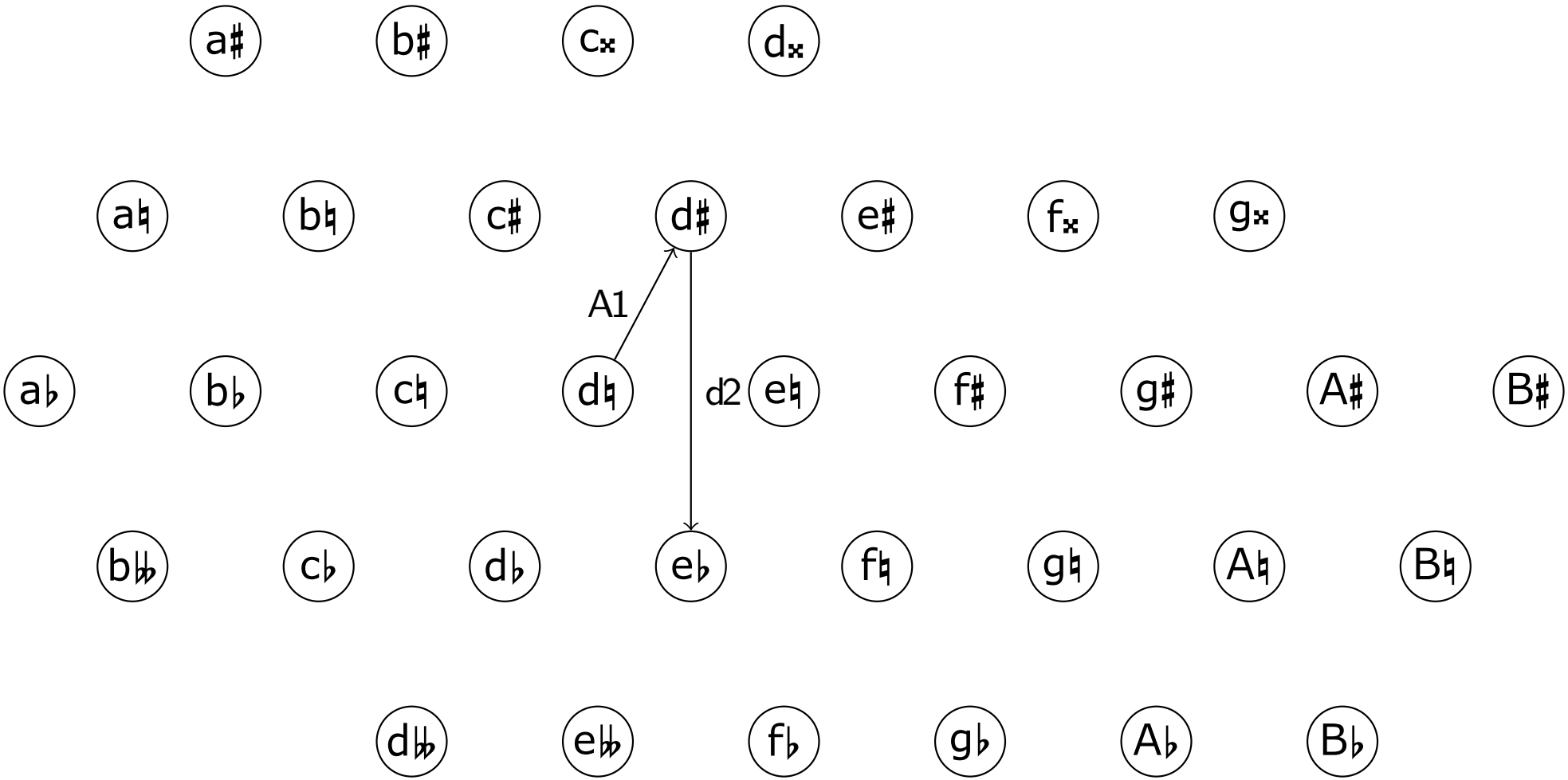

Theory

- 'Syntonic' temperaments assign two frequency ratios to the two generators
- 'Equal' temperaments project the two dimensions down to one

Theory

- Pythagorean

$$\mathrm{P5} \to 3/2, \quad \mathrm{P8} \to 2$$

- 'Quarter-comma meantone'

$$\mathrm{M3} \to 5/4, \quad \mathrm{P8} \to 2$$

Theory

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- 'Quarter-comma meantone'

$$\mathrm{M3} \to 5/4, \quad \mathrm{P8} \to 2$$

- 12-equal temperament

$$\mathrm{d2} \to 1, \quad \mathrm{P8} \to 2$$

- 19-equal temperament

$$\mathrm{dd2} \to 1, \quad \mathrm{P8} \to 2$$

- 31-equal temperament

$$\mathrm{dddd3} \to 1, \quad \mathrm{P8} \to 2$$

Implementation

- Flexibility (via typeclasses) in what counts as a `Pitch`, `Interval` or `Duration`
- A `Note` is an ordered pair (`Pitch`, `Duration`)
- A `Phrase` is just a linked list, [`Note`]
- A piece of music consists of a Rose tree of musical phrases
- Internally the preferred lattice basis is (A1, d2)
- Have to invert a $2 * 2$ matrix to calculate tuning map