w. When the fourth defining point D in a solid in space is moved to the plane γ_{ABC}, it collapses to that plane (see 5.1.1.2,o) and the circumscribed sphere collapse to a circle, (compare with chapter 5.3 Figure 5.31 and Figure 5.34).

6.1.2.1. The concept of Spatial Angular Structure

The idea of an angular circle rotation subject is representing a plane and gives raise to rotational symmetry in this plane, which we represent with a normal 1-vector for the rotation axis perpendicular to this circle plane. This symmetry plane ***direction primary quality of grade 2*** (***pqg***-2) we call the transversal plane to the axial normal ***direction pqg***-1.

In Figure 6.1,t we see two objects of these planes with an inclination. The angle between these inclining planes is defined as the angle between their normal 1-vectors $\measuredangle(\mathbf{n}_2, \mathbf{n}_1)$.

The intersection between these two inclining transversal planes form a line $\ell_{AC} \perp (\mathbf{n}_2 \wedge \mathbf{n}_1)$ perpendicular to their normal 1-vector axes that form a third transversal plane $\gamma_{\mathbf{n}_2\wedge\mathbf{n}_1}$, that a priori is perpendicular to two original planes $\gamma_{\perp\mathbf{n}_2}$ and $\gamma_{\perp\mathbf{n}_1}$. The causal third normal 1-vector σ_3 to $\gamma_{\perp\sigma_3} = \gamma_{\mathbf{n}_2\wedge\mathbf{n}_1}$ is parallel to the intersection line $\sigma_3 \| \ell_{AC}$.

In this way the idea of an axial structure in space along σ_3 as the intersection line between the two inclining planes is the angular generator for a cylindrical rotation around this intersection axis. This axial rotation symmetry is essential for the transversal plane waves of light.

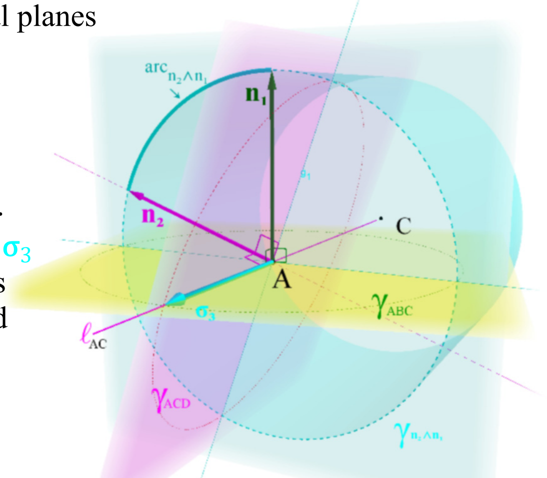

Figure 6.2 Axial cylinder symmetric rotation of a transversal plane field $\gamma_{\mathbf{n}_2\wedge\mathbf{n}_1}$

6.1.3. The Euclidean 1-vector Space for Natural Space.

In the tradition since Descartes the space extensions of *solid* is which has *length*, *breadth*, and *depth*. (E XI.De.1.), that led to the Cartesian 1-vector space $(V_3, \mathbb{R})$ with a Euclidean metric (5.51) is defined by an orthonormal basis set, e.g., $\{\sigma_1, \sigma_2, \sigma_3\}$.

An arbitrary 1-vector in this space can then be formed by

(6.2) $$\mathbf{x} = x_1\sigma_1 + x_2\sigma_2 + x_3\sigma_3 \in (V_3, \mathbb{R}) \sim \mathbb{R}^1_1 \oplus \mathbb{R}^1_2 \oplus \mathbb{R}^1_3 = \mathbb{R}^3_{1,2,3} \quad (\text{or} = \mathbb{R}^3_{xyz}).$$

A local point X position in space pointed out from an origo O by giving coordinates (x_1, x_2, x_3) in the three ***directions*** of the 1-vectors in a basis set $\{\sigma_1, \sigma_2, \sigma_3\}$ in Figure 6.3

6.1.3.2. Covariant Cartesian Coordinates

Given the orthonormal basis set of 1-vectors $\{\sigma_1, \sigma_2, \sigma_3\}$.
Each covariant coordinate is defined as the normal distance to the *transversal planes* through O from X, defined by

(6.3) $$\sigma_3\sigma_2 = \sigma_3 \wedge \sigma_2, \quad \sigma_1\sigma_3 = \sigma_1 \wedge \sigma_3, \quad \text{and} \quad \sigma_2\sigma_1 = \sigma_2 \wedge \sigma_1.$$

6.1.3.3. Contravariant Coordinates

When the basis is not Cartesian there are oblique angles between the normal transversal planes to the 1-vector axis $x^1\mathbf{n}_1$, $x^2\mathbf{n}_2$, $x^3\mathbf{n}_3$. Then the contravariant coordinates x^k are defined as the coordinate axis intersected by the parallel planes (hypersurfaces) formed by the two other axes respectively

(6.4) $$(\mathbf{n}_3 \wedge \mathbf{n}_2)\angle\mathbf{n}_1, \quad (\mathbf{n}_1 \wedge \mathbf{n}_3)\angle\mathbf{n}_2 \quad \text{and} \quad (\mathbf{n}_2 \wedge \mathbf{n}_1)\angle\mathbf{n}_3.$$

Then the addition form works, but not the Pythagorean.

(6.5) $$\mathbf{x} = \overrightarrow{\mathrm{OX}} = x^1\mathbf{n}_1 + x^2\mathbf{n}_2 + x^3\mathbf{n}_3, \quad \mathbf{x}^2 \neq {x^1}^2 + {x^3}^2 + {x^3}^2.$$

It is left to the reader to figurate this by an oblique prism.

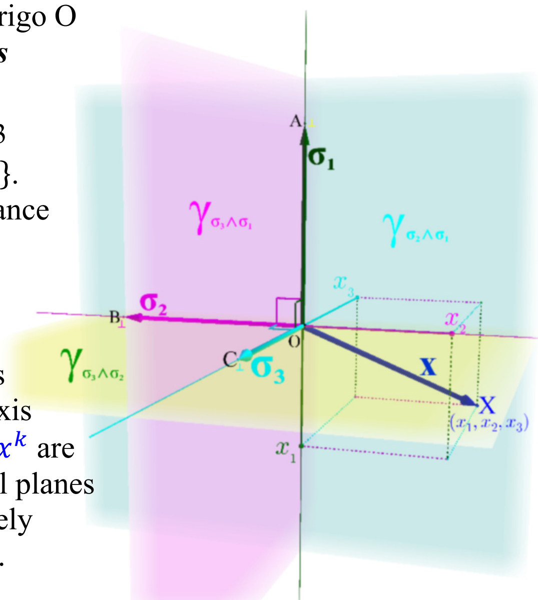

Figure 6.3
The Cartesian space coordinate system.

6.1.3.4. The Classical Cartesian Coordinate System for Position Points in $\mathfrak{Z}$-Space

The tradition says that we are pointing out three ***directions*** in natural physic $\mathfrak{Z}$-space by giving an orthonormal basis set of 1-vectors $\{\sigma_1, \sigma_2, \sigma_3\}$. The main problem here is that the coordinate axis for these ***directions*** do not necessarily intersects due to their translation invariance of the 1-vector idea. This demands us to choose an arbitrary origo O for the position coordinate system,[287] we name this cartesian system for $\{0, \sigma_1, \sigma_2, \sigma_3\}$.

When we have a central origo O in our world of the locality of what we call $\mathfrak{Z}$-space and we point out three perpendicular object ***directions*** $\sigma_1, \sigma_2, \sigma_3$, then we can point out a position

(6.6) $$\overrightarrow{\mathrm{OX}} = \mathbf{x} = x_1\sigma_1 + x_2\sigma_2 + x_3\sigma_3.$$

A point X in $\mathfrak{Z}$-space relative to origo O, demanded by the orthogonal 1-vector ***directions*** $\sigma_1, \sigma_2, \sigma_3$ and given by the real scalar coordinates that meet

(6.7) $$x_1 = \sigma_1 \cdot \mathbf{x}, \quad x_2 = \sigma_2 \cdot \mathbf{x}, \quad x_3 = \sigma_3 \cdot \mathbf{x}.$$

We see that the three orthogonal ***pqg***-1-vector ***directions*** for any physical $\mathfrak{Z}$-space ***entity*** not automatic point out an origo, we must do it ourselves in this simple Cartesian view. Instead, when we consider three non-parallel planes, we automatically get an intersecting origo.

First two inclining planes (E XI.De.6.), 6.1.2,t and 6.1.2.1 will intersect in a straight line. This line will intersect the third plane in just one point, that automatic will be an origo for these three inclining planes.

Do we have a physical entity, which can be characterised by three independent plane pqg-2 direction qualities there will always be one intersection point, which will form a locality center as an origo point for that ***entity***.

For the idea of three perpendicular planes, we can let their normal 1-vectors be the orthonormal basis $\{\sigma_1, \sigma_2, \sigma_3\}$. The intersections of these three planes will then implicit be the origo as a center of locality for these planes as shown Figure 6.4.[288] The translation of each plane will result in the translation of the locality center origo for the belonging ***entity*** through $\mathfrak{Z}$-space in that same ***direction***.

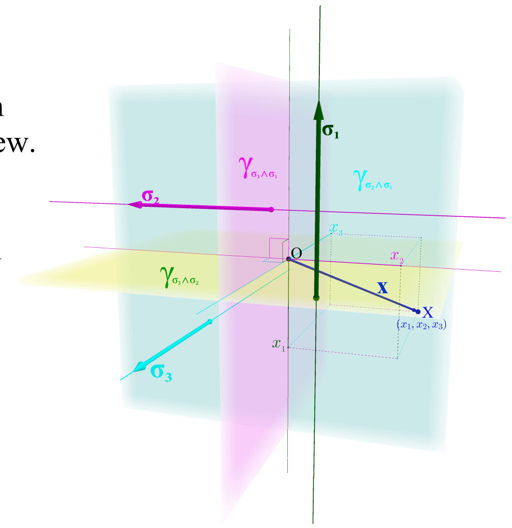

Figure 6.4 Three perpendicular planes intersect at just one point O. These planes are represented by their three orthogonal normal 1-vectors as basis $\{\sigma_1, \sigma_2, \sigma_3\}$ for their ***directions***. The axes for the drawn objects 1-vectors do not intersect.
This figure has reference to Figure 6.3.

6.1.4. A Curiosum, the Concept of a Tetraon in a Tetrahedron

Four points A, B, C, D are defining a solid span in space § 6.1.2, Figure 6.1,v.
Classically the Platonic tetrahedron is the ideal subject for the *simplest* solid object.
We will concentrate on the center of the locus situs and choose the circumscribed center O.
We form the 1-vectors from center to the four points $\mathbf{u}_a = \overrightarrow{\mathrm{OA}}$, $\mathbf{u}_b = \overrightarrow{\mathrm{OB}}$, $\mathbf{u}_c = \overrightarrow{\mathrm{OC}}$, and $\mathbf{u}_d = \overrightarrow{\mathrm{OD}}$, where due to the circumscribed circle $|\mathbf{u}_a| = |\mathbf{u}_b| = |\mathbf{u}_c| = |\mathbf{u}_d|$.
In stereo $\mathfrak{Z}$-space the fourth 1-vector is a linear combination of the three others, e.g.

(6.8) $$\mathbf{u}_d = \lambda^a\mathbf{u}_a + \lambda^b\mathbf{u}_b + \lambda^c\mathbf{u}_c, \text{ where } \lambda^a, \lambda^b, \lambda^c \in \mathbb{R},$$

As a performance in The 1-vector space $(V_3, \mathbb{R})$ for $\mathfrak{Z}$ is 3-dimensional $\dim(V_3) = 3$.

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[287] It is mandatory to say: There exists no 'GOD' for the 1-vector idea that makes these three intersect in one and the same point that we call an origo for any locality in $\mathfrak{Z}$ space. It is us that by an ingenious work construct an idea of an origo center for location, from which we can span the coordinate-axis from what we call an object 1-vector basis $\{0, \sigma_1, \sigma_2, \sigma_3\}$.

[288] We do not have to play 'GOD' for the 1-vector basis and make an external choice of origo. The idea of their transversal planes forms an automatic intersection that performs a center of locality for our idea of a physical ***entity*** that possesses plane qualities. An everyday example is: Two walls in a room meeting the floor making a corner vertex, that is an origo in practice.

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